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OBJECTS OF THE SOCIETY

The objects of the American Geographical Society are to collect and disseminate geographical information by discussion, lectures, and publications; to establish in the chief city of the United States a place where may be obtained accurate information on every part of the globe; and to encourage such exploring expeditions as seem likely to result in valuable discoveries in geography and the related sciences.

The American Geographical Society is the oldest geographical society in the United States. When it was founded, in 1852, there were but twelve similar societies in the world. Now it exchanges publications with more than four hundred scientific associations. The Society issues two monthly magazines of unusual appeal, *The Geographical Review*, which contains authoritative articles of general interest, and *The Journal of Geography*, which is devoted to the educational aspect of the subject. It has also a large and growing library—one of the most important geographical libraries of the world; thousands of maps and charts; and a remarkable collection of atlases of the sixteenth, seventeenth, and eighteenth centuries.

Travelers, men of science, and others properly accredited are welcome at the rooms of the Society and may freely use the book and map collections.

Two gold medals have been founded by the Society, the *Cullum Geographical Medal* and the *Charles P. Daly Medal*, which are awarded from time to time to explorers, writers, and men of science who have contributed to the advance of geographical knowledge.

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The annual dues are ten dollars.

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New York*

TABLE OF CONTENTS

PRINCIPAL ARTICLES

NORTH AMERICA

BROWN, R. M.	Five Years of the Panama Canal: An Evaluation.....	191-198
GRABAU, A. W.	The Niagara Cuesta from a New Viewpoint. (3 maps, 14 diagrs.)	264-276
SHELFORD, V. E.	Our Aquatic Biological Resources. (3 photos).....	250-263
WARD, R. DeC.	Cloudiness in the United States. (1 map, 16 diagrs.)....	347-356
WHITBECK, R. H.	The St. Louis Meeting of the Association of American Geographers.	139-140

SOUTH AMERICA

MCBRIDE, G. M.	Cotton Growing in South America. (1 map, 4 photos)	35-50
----------------	--	-------

EUROPE

—	Balkan Peninsula, The Natural Regions of the (<i>after Cvijić</i>). (1 insert map, 1 text map)	199-204
—	Bulgaria, The New Boundaries of. (2 maps)	299-305
CHAVANNES, PIERRE.	The Pays de Montbéliard. (1 map)	51-59
DAY, CLIVE.	The Pre-War Commerce and the Commercial Approaches of the Balkan Peninsula. (3 maps, 2 diagrs.).....	277-298

AFRICA

WALMSLEY, LEO.	The Recent Trans-African Flight and Its Lesson. (1 map, 8 photos)	149-160
----------------	---	---------

ASIA

BUTLER, H. C.	Desert Syria, The Land of a Lost Civilization. (1 insert map, 2 text maps, 28 photos)	77-108
CLAPP, F. G.	Along and Across the Great Wall of China. (1 insert map, 1 diagr., 23 photos)	221-249
STEIN, SIR AUREL.	Explorations in the Lop Desert. (1 map, 12 photos) ..	1-34
WILLIAMS, E. T.	The Open Ports of China. (1 map)	306-334

POLAR REGIONS

BRIDGMAN, H. L.	Peary: An Appreciation. (1 photo)	161-169
WISSLER, CLARK.	Arctic Geography and Eskimo Culture: A Review of Steensby's Work. (2 maps)	125-138

WORLD AS A WHOLE AND LARGER PARTS

DRYER, C. R.	Mackinder's 'World Island' and Its American "Satellite." (1 map)	205-207
ENGELN, O. D. VON.	The World's Food Resources	170-190

GENERAL

BABCOCK, W. H. Antillia and the Antilles. (5 maps)	109-124
BABCOCK, W. H. The Problem of Mayda, An Island Appearing on.. Medieval Maps. (5 maps).....	335-346
BRIDGMAN, H. L. Peary: An Appreciation. (1 photo)	161-169
JOHNSON, D. W. Some Recent Books on Military Geography.....	60-63

DEPARTMENTS

Geographical Record.....	64-69, 141-144, 208-212, 357-365
Geographical Reviews.....	70-76 (1 map), 145-148, 213-220, 366-372

Officers and Councilors of the American Geographical Society for 1920..	iii
Objects of the Society.....	iv
Index	373-387
Errata	388

Separate Illustrations

Map of Syria in the IV, V, VI Centuries [by HOWARD CROSBY BUTLER], 1:1,250,000	Pl. I, opp. p. 108
Map Showing the Natural Regions of the Balkan Peninsula (based on Civijić's "La Péninsule Balkanique"), 1:5,600,000	Pl. II, opp. p. 204
Map of the Great Wall of China, 1:2,000,000; with two insets: (1) The Palisade, An Extension of the Great Wall in Manchuria, 1:4,000,000, (2) Ancient Extension of the Great Wall in Northwestern Kansu (based on Sir Aurel Stein), 1:2,000,000.	Pl. III, opp. p. 248

THE GEOGRAPHICAL REVIEW

CONTENTS FOR JANUARY, 1920

Explorations in the Lop Desert. By Sir Aurel Stein. (1 map, 12 photos) 1

Cotton Growing in South America. By George McCutcheon McBride. (1 map, 4 photos) 35

The Pays de Montbéliard. By Pierre Chavannes. (1 map) 51

Some Recent Books on Military Geography. By Douglas W. Johnson 60

Geographical Record 64

<i>American Geographical Society</i>	<i>Africa</i>
Meetings of November, December, and January 64	Projected Railways Across the Sahara 68
Presentation of the Cullum Geographical Medal to Professor Henry Fairfield Osborn . . 64	<i>Asia</i>
Annual Reports of the Society . 65	Two Interesting Maps of Syria . 69
	Wasteful Exploitation of Manchurian Forests 69
<i>North America</i>	<i>Geographical News</i>
Snow and the Railroads . . 67	Obituary 69
A New Series of Rainfall Maps for the United States . . 67	
Geographical Reviews 70	

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OUR CONTRIBUTORS

Sir Aurel Stein is an eminent British archeologist and explorer, one of the foremost authorities on the early relations between China and the Western world. His investigations in this field were made chiefly on three expeditions to Chinese Turkestan, in 1900-01, 1906-08, and 1913-16. The present article deals with a part of the last journey. Of each of the first two journeys he has published popular and scientific accounts, as follows: first journey, "Sand-Buried Ruins of Khotan" (1903), and "Preliminary Report on a Journey of Archaeological and Topographical Exploration in Chinese Turkestan" (1901) and "Ancient Khotan" (1 vol. text, 1 vol. plates, 1907); second journey, "Ruins of Desert Cathay" (2 vols., 1912) and "Serindia" (in press). A preliminary account of the third journey appeared in the *Geographical Journal* for August and September, 1916.

Mr. McBride, lately librarian of the Society and an assistant editor of the *Review*, is intimately familiar with Latin-American conditions from a sojourn of several years in Bolivia and Chile. He is at present engaged in social welfare work in Mexico City. He has written "The Galápagos Islands" (*Geogr. Rev.*, Sept., 1918) and "Cotton and Human Affairs" (*Journ. of Geogr.*, March, 1920).

Pierre Chavannes is the *nom de plume* of Léon Marchand, a French author, native of Montbéliard.

Dr. Johnson is professor of physiography at Columbia University. In addition to numerous physiographical papers he has written "Shore Processes and Shoreline Development" (1919) and edited Professor W. M. Davis' "Geographical Essays" (1909). As major in the army he served as chief of the Division of Boundary Geography and member of several territorial commissions at the peace conference. In the domain of military geography he has written "Topography and Strategy in the War" (1917), an expanded reprint of articles that appeared in the *Bulletin of the American Geographical Society*, 1915, and the *Geographical Review*, 1916 and 1917.

THE GEOGRAPHICAL REVIEW

VOL. IX

JANUARY, 1920

No. 1

EXPLORATIONS IN THE LOP DESERT

By SIR AUREL STEIN, K.C.I.E., &c.

The journey to be described in these pages formed part of an extended trip undertaken under the auspices of the Indian government which during three years (1913-1916) carried me through the whole length of Central Asia, from Kashmir to the ancient Great Wall of China and back again to India across Turkestan and the eastern borderlands of Persia.* A brief account of it may serve to illustrate the geographical and archeological aims for the sake of which I returned to the dreary region where the Tarim River, and with it the united drainage of the huge basin of Chinese Turkestan, finally loses itself amidst wastes of dried-up salt marsh, bare clay, and drift sand.

Ever since my first visit to the Lop Desert in the winter of 1907, described in my "Ruins of Desert Cathay," the fascination of the region had drawn me. There were problems of distinct geographical interest, connected with the question of the "desiccation" of innermost Asia, to be studied in that desert depression, some 300 miles from east to west and about half the distance across, between the foot of the Altin-tagh, a range belonging to the Kwenlun system, on the south, and the barren hills of the Kurnuk-tagh, an outpost of the Tian-shan, on the north. Most of the ground still remained unexplored.

Equally attractive to me was the hope that I might find there ruined sites long ago abandoned to the desert and that they might yield to the spade more relics of that ancient civilization which, as the joint product of Indian, Chinese, and Classical influences, had once flourished in the Tarim Basin and upon which it has been my good fortune to throw light by my former explorations. Chinese historical records show that through those dismal and now wholly waterless tracts had once passed an important trade route, by which in the first centuries before and after the commence-

* A preliminary account of the whole journey, with map in 1:7,500,000, appeared in the *Geogr. Journ.*, Vol. 48, 1916, pp. 97-130 and 193-229.

ment of our era China secured its earliest direct contact with Central Asia, India, and the distant West. To trace this route right through over ground as yet unexplored was a task which by its combined geographical and historical interests forcibly appealed to me.

Work in the Lop Desert would be possible only during the few winter months when the severe cold permits of the carriage of water in the convenient form of ice. So, ever since my start from Kashmir at the end of July, 1913, I had been obliged to travel and work at high pressure in order to arrive in good time. By dint of constant exertions I had managed to accomplish the journey of some 2,200 miles across little-known portions of the ice-clad Hindukush ranges, the Pamirs, and along the whole length of the great Takla-makan Desert, that true "sea of sand," in a little over five months, and at the same time to carry out what new explorations my routes offered a chance for.

ENTRANCE INTO THE LOP REGION

On January 8, 1914, I arrived at Charkhlik (map, Fig. 1) together with three of my Indian assistants. A few days later I had the satisfaction of being rejoined by Rai Bahadur Lal Singh, my faithful old travel companion from the Survey of India, who during a separation of nearly four months had been effecting important surveys along the high main range of the Kwenlun. It was at that little oasis, the only settlement of any importance in the Lop region, that I had to procure the whole of the supplies, labor, and extra camels which our several parties would need in the desert eastwards.

I found the difficulties of this task greatly increased by a local upheaval, characteristic of the troubled conditions of Chinese Turkestan, which had just preceded my arrival. It was a queer story, this irruption of a band of Chinese "revolutionaries," *recte* bandits, from Charchan who, without interference from the Turki Mohammedan population, had murdered the local Chinese magistrate and set up their leader as *amban* in his place, only to be within a week surprised and killed in turn by a party of Tungan troops in the pay of the provincial "government." All Chinese civil authority had disappeared, without which no effective help could be hoped for from the easy-going Lopliks and their indolent *begs*. The passage of fresh bodies of Tungan troops threatened completely to exhaust what slender supplies the two hundred homesteads of Charkhlik still retained.

ARCHEOLOGICAL WORK AT MIRAN

After six days' anxious stay at Charkhlik we transferred our base to Miran, two long marches away to the east, the last spot of cultivation on that lonely track through the "Desert of Lop" which Marco Polo followed about 1273 on his one month's caravan journey to Sha-chou, or Tun-huang,

on the westernmost border of China proper. In 1907 I had made important discoveries there among ruins which mark the site of the earliest capital of the Kingdom of Shan-shan or Lou-lan, as the Chinese annals

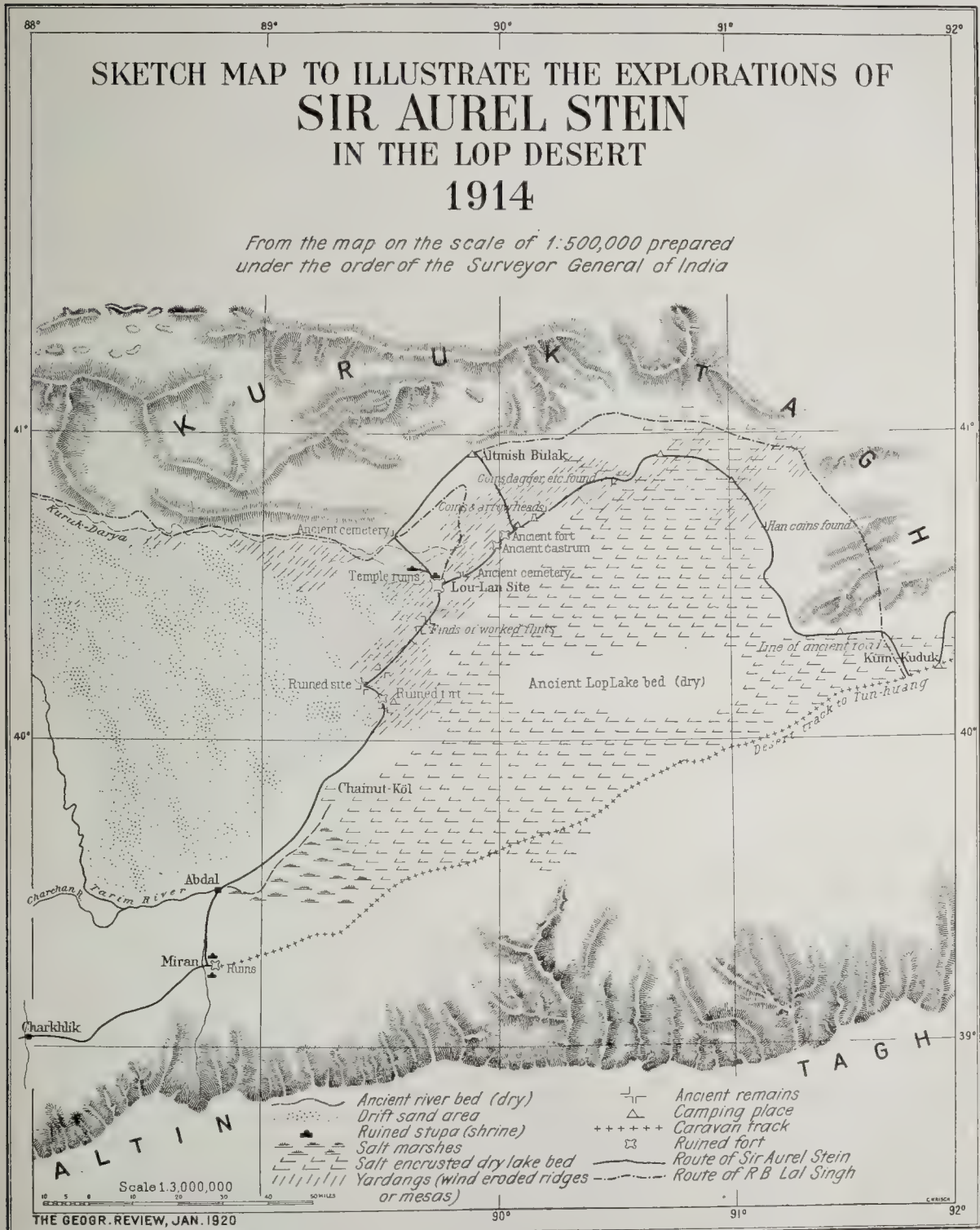


FIG. 1

call it, corresponding to the present Lop region. From two ruined Buddhist shrines, dating from the early centuries of our era, I had brought to light wall paintings of supreme artistic interest, strikingly reflecting the



FIG. 2.—Interior of ancient fort with wind-breached portion of rampart, southwest of Lou-lan site. Heavy timber debris in foreground marks position of

influence of the Greco-Buddhist art of the northwestern frontier of India, and some almost Hellenistic in character. Owing to shortness of time and technical difficulties we had then been able to remove the frescoes from only one of these temples. The recovery of what survived in the other temple proved a very delicate task. The icy blasts which almost constantly sweep across the bare gravel glacis at the foot of the Altin-tagh made the work particularly trying. But in the end we succeeded in removing and packing with all needful care for their long journey to India the friable plaster panels of the fine frescoed dado with its cycle of youthful figures, set between graceful garland-carrying putti.

Strange, indeed, seemed the contrast between the pleasures of life, symbolized on these crumbling walls by some modest artist from the far-off Hellenized East, and the lifeless desolation of the ruined site as it now is. But it impressed itself even more strongly upon me through the manifold anxieties and cares which attended my fortnight's labors at Miran. I knew that a timely start was essential for the execution of the explorations I had planned in the waterless desert north and northeast of the present Lop-nor marshes. It was certain that without adequate transport and supplies it would be impossible to effect the whole of my program or even to transport my heavy baggage by the desert track towards Tun-huang.

PREPARATIONS FOR THE DESERT JOURNEY

For the sake of my proposed excavations I needed to take a comparatively large party of laborers into the desert, and my own fifteen stout camels would not have sufficed merely for the carriage of the ice which was to keep us all supplied with the minimum provision of water and still less for that of the indispensable food and equipment. In the disturbed state of affairs at Charkhlik it had been impossible to secure hired camels besides the seven I managed to bring from Charchan. My supplies for men and beasts during a minimum of two and a half months were equally far from completeness.

Amidst all these preoccupations there appeared unexpectedly, as we were at work at the ruined temple, Sher Ali Khan, an enterprising Pathan trader from Bajaur, now on his way to Khotan with silk and tea from distant Szechwan. I greeted his burly figure clad in heavy furs with delighted surprise. Seven years before I had met him at Tun-huang, and, as an old acquaintance and mindful of what he owed to the *sircar* as an Indian subject, he was eager to help.

In his caravan were ten hired camels from Tun-huang which, after a good rest, might become fit for facing the long journey back under loads. In addition, the lucky encounter enabled me to confide to the care of this trustworthy merchant the heavy cases with frescoes and other antiques which my excavations at Miran had yielded, for safe transport to the

British Consulate at Kashgar, some two months' caravan journey westwards.

It was of some advantage, too, that the dozen families of Lopliks, who formerly dwelt at Abdal, near the marshes of Lop-nor, as semi-nomadic fishermen and hunters, had since 1908 transferred their homesteads to the patches of land now again after centuries of abandonment irrigated from the stream of Miran. The fact of their transformation into casual agriculturists made it easier to secure from among them laborers, together with a few camels and some additional supplies.



FIG. 3—Remains of ruined *stupa*, or shrine, on wind-eroded terrace, Lou-lan site. (Naik Shams Din in middle of ruined mound.)

On January 23 I started Lal Singh to Tikenlik, a small Lop colony seven marches northward by the terminal course of the Tarim. There, if all went well, he would pick up the seven strong camels I had asked Abdur Rahim, the hardy hunter from Singer and my old guide of 1907 in the Kuruk-tagh, to provide. From Tikenlik Lal Singh was to carry out a survey of the ancient dry river bed and its branches by which the waters of the Konche-darya once reached the area, now wholly desiccated desert, south of the Kuruk-tagh foothills. There Sven Hedin had discovered in 1900 the ruins of the "Lou-lan" site which seven years later yielded me abundant archeological spoil, and there was to be our rendezvous.

Some days after Lal Singh's departure I sent off Muhammad Yakub Khan, my second Indian surveyor, by the desert track leading to Tun-

huang, in order to carry a series of exact leveling operations from the northeastern end of the great salt-encrusted basin which marks the ancient dried-up Lop Lake, to the point where, I believe, the drainage of the Su-lo Ho coming from the far-off Nan-shan ranges had once joined it.

My own tasks included the excavation and clearing of any ruins which might be revealed by the exploration of the dried-up delta of the Kuruk-darya, or "Dry River," and the search for the ancient Chinese route once leading eastward from Lou-lan. Adequate time had to be assured for the latter rather hazardous task and for the survey of the unexplored northern



FIG. 4—Ruined dwelling on wind-eroded terrace, with *stupa* ruin on right, Lou-lan site. (Laborer on top of terrace marks original ground level.)

and eastern portions of the great salt-encrusted lake bed which, there was reason to assume, that ancient route must have passed through or skirted. All this would have to be done before the winter cold broke up or the staying power of the camels, on which everything depended, became exhausted.

What with big loads of ice sufficient to assure minimum allowances of water for thirty-five people for at least one month; with food supplies for one month for all and for an additional month for my own people; and with the indispensable outfit of tents, furs, felts, etc., to afford protection in the wintry desert exposed to freezing gales, the thirty camels I had succeeded with great difficulty in procuring, including my own, were by no means too many. It goes without saying that everybody had to walk and that the twenty-five laborers taken had to help by the carriage of light loads.

NATIVE PERSONNEL OF THE PARTY

Most of them were hardy Lopliks, inured to privations and exposure in the desert by generations of semi-nomadic existence and yet accustomed, too, by the recent change in their condition of life to wielding the *ketman*, or hoe, that excellent implement of the Turkestan digger. I also had the support of my trusted old Loplik follower, Tokhta Akhun. First employed by Sven Hedin, he had previously proved most useful to me by his pluck and his instinct of the born hunter of wild camels. A curious contrast to him was Hassan Akhun, my quicksilver head cameleer from Kashgar, with whom readers of my former personal narratives, "Sand-Buried Ruins of Khotan" and "Ruins of Desert Cathay," have become acquainted. To no one could I have entrusted the care of the brave camels with more confidence than to him. Ever quarrelsome, full of conceit, and the possessor of a terribly sharp tongue, the small but wiry fellow was a very difficult person to manage on ordinary caravan journeys and still more so when near the temptations of bazars in villages or towns. But he possessed all the knowledge and skill of the born cameleer which only inherited instinct and long early training can give. It was he who had selected for me from the summer grazing grounds in the outer hills south of Khotan the fifteen fine camels which were to be my "ships of the desert" on this journey.

His staff was completed by his nephew, young Mahmud, a chubby and rather phlegmatic boy, and by Mahmud "the big," a quiet young Khotanese whom I had transferred from Lal Singh's party and who in time learned to accommodate himself to his imperious "skipper's" ways.

January 31 was my last day at Miran and a terribly busy one. Short as we were of camels, fresh trouble had arisen two days before by two of our own having strayed from the scrubby jungle belt near the Miran stream. They had been tracked into the desert towards Charkhlik, and search parties had to be organized to secure them if possible.

START OF THE DESERT JOURNEY

The next morning I had the satisfaction of seeing my large column started at last for the desert northeastward. It had cost great efforts to organize it at this last humble outpost of Turkestan civilization, and the trouble and pressure involved had, no doubt, been felt by the easy-going Lopliks; but, when the leave-taking was all done and rewards had been duly deposited, I could see in their honest Mongolian faces only the reflection of kindly feelings and good wishes for my success. Rarely had the Turki farewell, "*Yol bolsun*" ("May there be a road"), sounded in my ears so pregnant with meaning.

There was delightful peace and a sense of nature still alive in the belt of thickly growing wild poplars through which our track first led along the dying course of the Miran stream. Then we passed into a zone of

somber tamarisk-covered sand cones, typical of the true desert margin in the south of the Takla-makan, and finally, crossing a dismal expanse of absolutely bare salt-impregnated plain, reached the bank of the Tarim by nightfall. A little cluster of mud hovels and reed huts marked the abandoned fishing hamlet of Abdal. But one of these had been kept habitable by Tokhta Akhun and, fitted for the occasion with warm felt rugs, offered welcome shelter for my first good night's rest after many anxious weeks.

The nights were still bitterly cold—during one of them the minimum thermometer registered -12° F., and a strong sheet of ice covered the deep but narrow channel through which the Tarim in its sluggish terminal course empties itself below Abdal into the marshes and lagoons of Lop-nor; and so the crossing of our many camels with their loads to its north bank could be effected with ease in the morning. It was strange to feel that in crossing those forty yards of ice we had passed over all that was left of the waters, so extensive in spring and summer, which the glacier-clad high ranges of the Kwenlun, the eastern Pamirs, and the Tian-shan send down into the huge Tarim Basin.

A cloudy sky and the dust haze raised by the bitter northeast wind blowing into our faces made the ground traversed in the day's march look even more lugubrious than it was by nature. A succession of dreary reed-covered marshes on our right fringed the course of the dying Tarim, while northward extended a bare sandy plain with thin scrub and scanty tamarisk-crowned sand cones, the slow growth of centuries along the edge of the true desert of drift sand. Far away were dimly seen the soft outlines of its yellow big dunes. We followed a well-marked track of Loplik fishing parties and hunters, and in the late afternoon it brought us to a string of small lagoons fed by the spring floods of the Tarim, the last place where we could find good ice to carry into the desert.

The ice was nearly a foot in thickness and tasted perfectly fresh, though the water was very brackish and scarcely drinkable for men. All through the night the ice cutting and packing continued by the light of bonfires, and by dawn next morning forty-three bags were ready. They had been tied under Hassan Akhun's expert direction to those *shotas*, or pairs of short ladders, which throughout Turkestan serve for the convenient carriage of camels' loads. When at last the convoy was started, with all camels heavily laden and twenty carrying ice, progress was necessarily slow. All day we passed between or across dry lagoons, covered with a thin crust of salt, or *shōr*, which on my march to Lou-lan in December, 1906, had still held water. The total absence of live vegetation near these lake beds was striking, as if the hardy reeds and tamarisks of the desert edge had been too wary to plant themselves near such short-lived inundations of the dying river. It is different with the fish, as Tokhta Akhun explained from long experience. Having been carried into these depres-

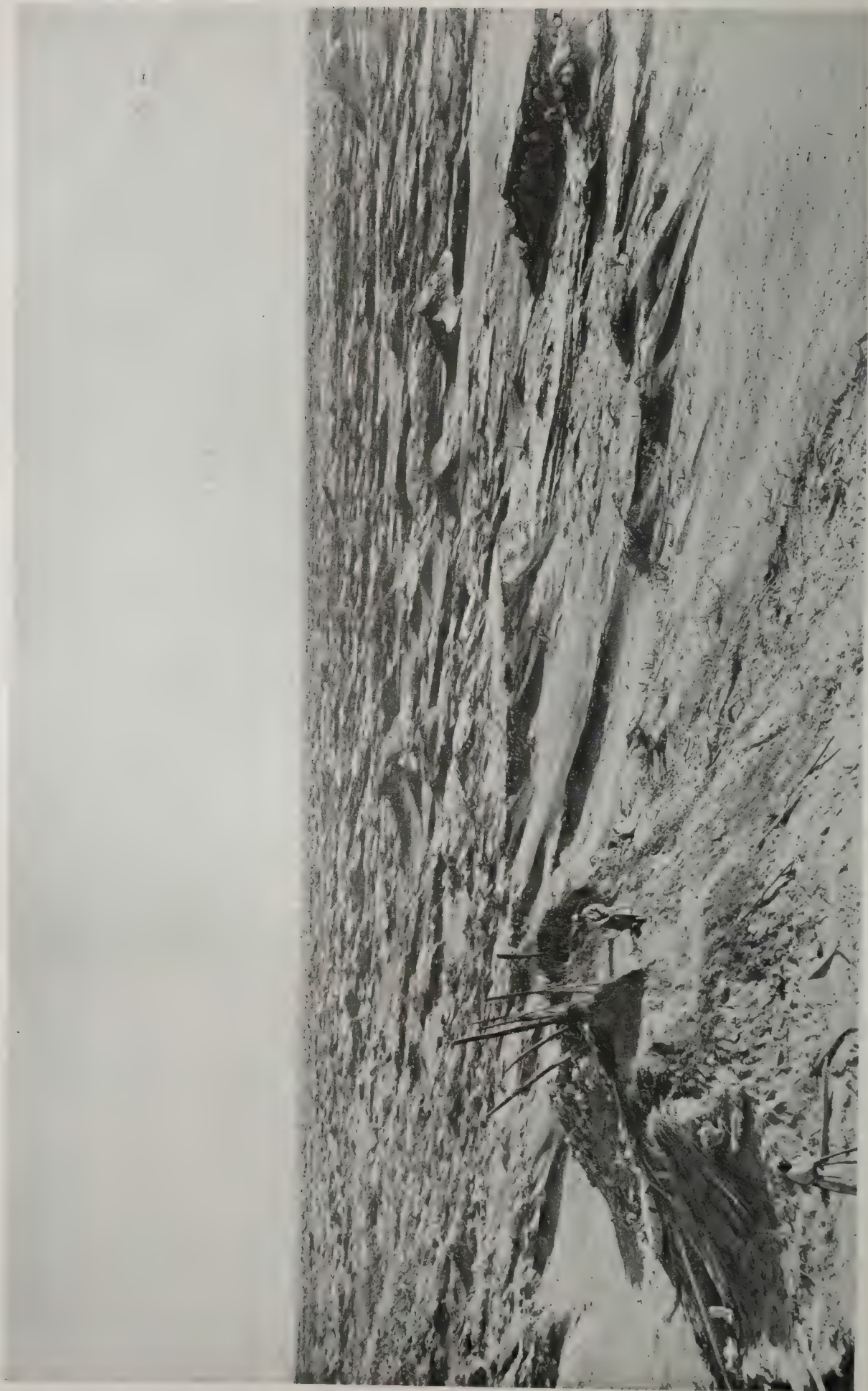


FIG. 5.—Wind-eroded clay ridges (*pandangs*) with remains of ruined dwelling in fore, Lou-lan site.

sions whenever exceptional spring floods fill them at intervals, they remain behind while the channel that brought the fresh water gradually dries up. As the water left in such lagoons gets more and more brackish, the fish rise nearer to the surface and are then caught with ease by the Lopliks.

NATURE OF THE COUNTRY TRAVERSED

Next morning we set out for our immediate goal, a ruined fort in the desert northward which Tokhta Akhun had sighted, apparently in 1910, when he returned from the Lou-lan site after guiding thither Mr. Tachibana, the young Japanese explorer. On the morning of February 4 I started my caravan with confidence. The atmosphere had cleared with the rapidity characteristic of the desert winter, and, as if to assure me of the accuracy of our plane-table survey, there showed clearly about eighty miles away to the south the snow-covered Kwenlun range.

The ground traversed on the day's march was still easy, permitting the camels in spite of their heavy loads to maintain a steady rate of two miles an hour. The succession of wide shallow lake beds which we crossed or passed by showed signs of having dried up recently. Only boggy patches remained, and at one point some small pools. Their water was so salt that no ice had formed over them. Towards the end of the march we came upon the first patches of ground cut up by the erosive action of the wind into small clay ridges with shallow trenches between, all running from east-northeast to west-southwest. They were the familiar *yardangs* of the desert round the Lou-lan ruins (see Fig. 5).

I did not feel sorry when the troublesome belt of *yardangs* gave way again to a wide dry lake bed with patches of reeds and low thorny scrub growing on its northern edge. It was the last chance of some grazing for the camels, and not without good reason had Tokhta Akhun chosen the spot for the night's camp. A group of high sand cones covered with thick tamarisk growth mostly dead served him as a convenient guiding point and now furnished some shelter for the men and abundance of fuel for the camp fires. The first distribution of ice was made that evening by Naik Shams Din, my "handy man" from the Bengal Sappers and Miners, to everyone in our large party. All the men had been made to bring their main food supplies in the shape of ready-baked small loaves of bread; and so the daily issue to them of ice could be limited to a quantity sufficient to provide about three pints of water for the jug of tea required by each one in the evening and again in the morning.

An early start was assured the next morning. Climbing, as soon as the sun rose, a big tamarisk cone some forty feet high, I had the satisfaction of sighting through a powerful binocular the ruin we were bound for far away on the hazy horizon. The ground crossed as we steered towards it was desolate in the extreme. Not a trace of living vegetation survived

on the expanse of bare clay which the erosive action of wind had cut up into an unending succession of steep terraces separated by trenches and troughs. Their direction, invariably running east-northeast to west-northwest as elsewhere throughout the Lop Desert, showed plainly how the prevailing winds have during countless ages swept down from the cold uplands of southern Mongolia into the depressed Lop-nor basin.

PREHISTORIC AND HISTORIC FINDS

Forewarned by experience on my former journey I had told the men to keep a close lookout for relics exposed by wind erosion, and scarcely had we covered six miles in our weary tramp across *yardangs* when the first stone implement, a flint arrowhead, was picked up under my eyes. The promised small rewards, promptly paid, made everybody keen for this hunt, and the finds increased so rapidly that I had my hands and pockets soon filled with them.

All kinds of simple implements of the Stone Age were represented among these finds, the small saws, knives, and scrapers of Paleolithic man, as well as stone arrowheads and celts of a more advanced stage. Potsherds, too, of Neolithic type soon appeared in plenty. There could be no doubt that we were passing across a belt which in prehistoric times must have been regularly inhabited. Presently we picked up a well-preserved Chinese copper coin of the type which was common under the Han dynasty immediately before and after the beginning of our era.

As more coin fragments of the same type followed it was clear that occupation had here continued into the earliest historical period as yet traceable in the Lop-nor region. Then we came upon a broad bed running west to east, shown unmistakably as that of a river by its uniform depth, its winding banks, and the rows of dead *toghraks*, or wild poplars, which lined them. Shriveled and bleached by centuries of exposure, some of the gaunt trunks still stood upright.

EXPLORATION OF A RUINED FORT

A mile farther on we reached the ruined fort (Fig. 2). Its ramparts, forming a square of about 200 yards, rose boldly above the ground outside, which erosion had cut up and lowered in places fully fifteen feet below the original level. Their solid construction in layers of brushwood fascines and wild poplar trunks alternating with layers of stamped clay, fully 32 feet wide at the base, would alone have sufficed to assure me of the antiquity of the ruin; for it was the same system which I had found before in all fortified posts and stations built by the Chinese on their first advance into the Tarim Basin. Rapidly we unloaded the camels and stacked their precious loads of ice under the north wall of the fort where its foot, partially undercut by wind erosion, offered shade and protection from the



FIG. 6



FIG. 7

FIG. 6—Interior of ancient Chinese fort, with ramparts built of reed fascines. (Top of débris-covered mound marks original ground level before wind erosion.)

FIG. 7—Wind-eroded clay ridge, northeast of Lou-lan site, bearing remains of ancient fort.

midday sun. Then Afrazgul, with Niaz Pawan, a young Loplik hunter, and two camels carrying light loads of indispensable food, ice, and kit, was despatched westwards to reconnoiter a second small fort which Tokhta Akhun had reported and to search for more ruins along the ancient river course we had crossed.

I lost no time in exploring the fort. It was marked by foundation beams, some of them thirty feet in length, indicating a structure of a very solid type. Portions of the wall were built of timber and plaster. Wherever breaches occurred in the walls sand had entered and much sand-blasting had been done. The eastern wall was well preserved, for much drift sand had collected in the leeward side of the rampart, filling the rooms here to a height of seven feet and more. This heavy cover of sand had preserved the internal arrangements, such as sitting platforms, fireplaces, carved posts supporting the ceiling, in good condition.

The doors by which the rooms communicated with each other were still in their places, with folds ajar, just as the last occupants had left them. One still retained the coarse string intended for its fastening. One of the rooms, in which we found a small clay-built platform with its top reddened by fire and close by a roughly carved wooden trough probably used as a cooling tank, had evidently been tenanted by a blacksmith. Fragments of large jars in coarse pottery and of a few iron instruments had been left behind; but otherwise there was a curious absence of signs of continuous occupation.

Everything pointed to the little fort's having probably been intended to serve as a station on the direct route connecting the Lou-lan settlement with Miran, the ancient capital of the Lop region. There was an absence of agricultural implements and of indications of local cultivation, the straw in the plaster of the walls was all of reeds, and all the timber was of riverine jungle. Owing to its distance from cultivated ground the site had been occupied only at intervals. Our survey proved that it lay on the straight line leading from Miran to Lou-lan, almost exactly halfway between the latter and the nearest point on the Tarim. The Chinese copper coins and other small metal objects which the men picked up in numbers on eroded soil near the fort left no doubt of its dating back to the early period of Chinese occupation in the first centuries of our era.

EXCAVATION OF A NEAR-BY RUINED SITE

Soon Afrazgul returned from his reconnaissance bringing good news. Northwest of Tokhta Akhun's second ruined *kurghan* he had come upon a scattered group of small ruins, unmistakably those of houses, where he found coins, beads, and other small objects. Leaving Afrazgul behind to make an accurate plan of the large fort, I moved out next morning with my posse of diggers to the new field of work.

Tokhta Akhun's second *kurghan* proved a small circumvallation of the same type, measuring inside some 70 yards by 46. In spite of the solid construction in which courses of tamarisk fascines alternated with thicker layers of clay, the destructive force of erosion had here, too, completely effaced the northeastern portion of the ramparts. No trace of any structural remains in the interior could be found. But within the southeastern corner a small area of the ground had received protection by a thick deposit of refuse, consisting mainly of reed straw and dung. Evidently at one time the place had been used as a shelter by shepherds.

As the men proceeded to dig away at the litter there emerged abundant rags of felt and coarse fabrics in wool and linen, together with a few pieces of silk, one showing a neat knot-dyed pattern. I had told the diggers to look out carefully for any fragments of paper, with the promise of a good reward for any piece that might show writing. There was no little excitement when there went up the first shout of "*khat!*" (i. e. writing). It was a tiny piece of thin paper, only about two inches square. But, as I unfolded it with fingers half benumbed from the cold north-east wind, I recognized to my great delight a few characters recalling the old Aramaic-like script of which the few Early Sogdian documents first discovered by me in 1907 at the Lou-lan site and on the ancient Chinese border line of Tun-huang had so far remained the only known specimens.

Three miles farther on, across troublesome *yardangs* and low dunes, there was an ancient river bed clearly marked by dead *toghrak* trunks and, on either bank, appeared widely scattered the skeleton-like remains of half-a-dozen ruined structures. In each case they occupied the top of steep terraces of clay, resembling small islands which wind erosion had carved out from what was once the level area of houses.

It was clear that the erosive action of wind-driven sand had worked terrible havoc here, and when I approached the first ruin it did not surprise me to find that the wattle-and-timber wall still surviving of the large central hall rose only two feet or so above the ground. But fortunately a thick refuse layer had helped to protect the original floors here and in portions of the rooms once adjoining.

As soon as we began to clear it there emerged pieces of fine colored rugs and other fabrics in abundance from beneath reed straw, camel dung, and the like. Soon there followed Chinese paper documents, one quite large, and a fragment of a text beautifully written in that modification of ancient Indian script known as Central Asian Brahmi. When at last there appeared a small wedge-shaped record on wood in an early Indian language and the same Kharoshthi writing which I knew so well from hundreds of wooden documents of the third century A. D. unearthed at the Niya site in the south-central Takla-makan, there remained no possible doubt about the early date of these ruins and the civilization to which they belonged.

Interesting finds, too, of small objects of personal or household use came



FIG. 8



to light in plenty, closely agreeing in type with those recovered before from the Lou-lan site. There were strips of brocade and pieces of a bag in many-colored silk; fragments of a richly ornamented headpiece with bridle in leather and bronze; a finely carved wooden cup and bowl; two large eating trays of wood, etc. From a sheltered corner there turned up in quick succession four large boards beautifully lacquered in Pompeian red and decorated with bronze studs which must have formed originally part of a box, besides many other objects of smaller size, such as an arrow shaft, spindle, bone spoon, etc. In the central hall the massive wooden pillar, about 15 feet long, which had carried the roof, lay athwart the floor; and, owing to the protection provided by a raised sitting platform on one side, the boldly carved double bracket in wood with fine volutes which had once surmounted it was recovered in perfect condition. Encouraged by well-earned rewards the men worked their *ketmans* with zeal.

Those houses where rubbish heaps had helped to ward off erosion from the original floors yielded more relics of interest, including paper documents in Chinese and ancient Indian scripts. The discovery of a well-preserved record containing ten lines of neatly written Early Sogdian text rejoiced me greatly; for, apart from its philological value, it confirmed my identification of the tiny fragment already unearthed. At other ruins, where the force of erosion had swept the ground bare except for the heavy timber and any hard débris, we had to be content with remains of architectural carvings, of miscellaneous objects in metal and stone, of fragments of pottery, glassware, and the like. To give some idea of the destructive power of the slow but unceasing erosive agency at work, it may be stated that at one of the badly attacked ruins I found the adjoining ground scooped out to a depth of fully 22 feet below the original level.

The antiquarian evidence obtained sufficed to establish the essential fact that the settlement, probably agricultural in part, had been occupied down to the beginning of the fourth century of our era, and by people sharing the same civilization, due to the mixture of Indian, Chinese, and Western influences, which my finds of 1906-1907 at Lou-lan and Miran had illustrated. A variety of physical features observed in the immediate vicinity of the ruined settlement threw fresh light, too, on the hydrography and early occupation of this now waterless part of the Lop-nor region during historical times and those immediately preceding them. For the latter the abundant finds of stone implements such as Neolithic arrowheads and jade celts, which we picked up from the eroded surface of the ground near these ruins, afforded safe guidance.

SOJOURN AT THE LOU-LAN SITE

I now turned towards the main Lou-lan site which I intended to make my base for our next explorations. Leaving behind the heavier antiques

to be picked up later, I started my column in the early morning of February 9 for the new goal.

Our crossing was favored by an atmosphere of unusual clearness for this wind-swept desert; and, when after a tramp of close on twenty miles we pitched camp in a belt of ancient riverine jungle, the glorious evening light seemed to diffuse warm life and beauty over this strange landscape in spite of the deathlike torpor in which it has lain for centuries. Far away to the north showed up the reddish crest line of the barren Kuruktagh hills. Its sight raised the spirits of the men quite as much as the roaring camp fires which the abundance of ancient firewood allowed them to keep up.

We had not marched more than five miles the next morning when the appearance on the bare eroded soil of fragments of bronze ornaments and glassware, soon followed by Chinese copper coins of the Han type, proved that we had entered that belt of the ancient delta to which occupation in the early centuries of our era extended. That the bare clay of the ground became more and more a close maze of steep ridges and furrows was another indication of our nearing the Lou-lan ruins. At last, climbing with Tokhta Akhun to the top of an isolated dead tamarisk cone, I sighted far away, and only a few degrees out of the bearing we had tried to steer, the ruined *stupa* tower which I remembered as the landmark of the main site of Lou-lan.

During the next three days we were kept busy at this ancient station. The varied finds of antiques and documents which our explorations yielded made it certain that the ruined site, though small in size, had served as an important administrative post on that ancient route by which Chinese commercial and political expansion first penetrated into Central Asia at the close of the second century before Christ. The difficulties of this desert route, owing to the want of water over a great portion of it, must always have been very serious; and early in the fourth century A. D., as the critical examination of the Chinese manuscript finds from the site made by M. Chavannes, my distinguished Sinologue collaborator, clearly shows, it was deserted altogether. From the archeological evidence collected by me, it is safe to conclude that about the same time the settlement of which the Lou-lan site was the chief place was finally abandoned to the desert. It seems probable that the event was directly connected with the drying up of the ancient river bed of the Kuruk-darya, which previously had carried the waters of the Konche-darya, now absorbed by the Tarim, to the settlement and upon which its existence must have wholly depended.

To search for the line of the ancient Chinese route eastward beyond the Lou-lan station and for any remains which might be found along it was the main task which had brought me back to this forbidding desert. It was only towards the end of my previous visit in 1906 that the extensive rubbish heaps, covering the ground around what had been the administra-

tive headquarters, or *yamên*, of the old Chinese station, revealed themselves in their true meaning as mines of records of all sorts thrown out as "waste paper." A further number of ancient documents on wood and paper were now recovered. Chinese records formed the great majority; but our careful search brought to light also Kharoshthi tablets, some showing the oblong official shape evidently connected with the indigenous administration, and a complete letter in the same early Indian script written on a piece of silk which had subsequently been sewn up to form a bag, besides several paper records in the Early Sogdian language.

The same fierce east-northeast wind prevailing during the greatest part of the year which has sculptured the soil of the Lou-lan tract into *yardangs*, since it lost its water and with it the protecting cover of vegetation some sixteen hundred years ago, had sufficed to grind down and carry off almost completely the eastern and western faces of the circumvallation of the ancient Lou-lan station which stood across its course and against which it acted with full force. The northern and southern walls owed their partial survival to the fact that they stretched in the direction of the prevailing wind and thus offered far less scope for its erosive action. The whole circumvallation formed a square of approximately a quarter mile on each side, and observation with the prismatic compass proved that the ancient Chinese engineers had been careful to adapt its orientation exactly to the prevailing direction of the wind, thus assuring the maximum of shelter for the occupants as long as the walls would hold out against that incessant assault.

EXCAVATING NEAR LOU-LAN

On the bitterly cold morning of February 14 with the temperature at -12° F. I took the laborers out to the nearest of the ruins toward the west, which had been discovered by Lal Singh in his reconnaissance survey of the dead channels of the dry river. After some interesting geographical observations on the temporary return of moisture after a prolonged period of drought and after further collections of ancient stationery in wood, curious household implements, and a decorated bronze mirror, I set out for the more distant ruins to the northeast. In time we came to some small bronze fragments and potsherds, indicating that the ground had once been occupied. At length we came to an ancient burial site with large grave pits marked by rough tamarisk posts.

We found here an abundance of household implements of all sorts, objects of personal use such as artistically decorated bronze mirrors, wooden models of weapons, Chinese records on paper and wood, and, above all, a wonderful variety of fabrics of all hues which delighted my eyes. Among them were beautifully colored silks, pieces of rich brocade and embroidery, fragments of fine pile carpets, by the side of coarse fabrics in wool and felt. It soon became clear that these remnants of garments of

all sorts had been used for wrapping up bodies, perhaps partially embalmed; and the experience gained by me a year later in the exploration of cemeteries of the Tang period at Turfan has fully confirmed this conclusion. I could not have hoped for a more representative exhibition of that ancient silk trade which we know to have been a chief factor in opening up this earliest route for China's direct intercourse with Central Asia and the distant West.

I soon realized from various indications that the contents of these pits must have been collected, before the final abandonment of the Chinese



FIG. 10—Camels marching between salt-encrusted ridges near northeastern shore of ancient dried-up Lop-nor.

station of Lou-lan, from older graves which wind erosion or some similar risk was threatening. Consequently all the relics here saved from destruction, in obedience to a pious custom still prevalent among the Chinese, could safely be assigned to that period of the Han dynasty which followed the first expansion of Chinese trade and political influence into Central Asia about the close of the second century before Christ. In any case none of the remains could be later than the third century of our era.

EXPLORATION OF AN ANCIENT FORTIFIED STATION

We next sought the large walled enclosure of which Afrazgul had told me and whose dark-outlined ramparts had helped to guide us from afar. It was a long weary tramp. But all fatigue was forgotten over the delight of the interesting discovery made upon arriving. The walls of the ancient

station, forming a square of about 450 feet and remarkably well preserved in spite of twenty centuries of exposure, were built with regular layers of stamped clay and carefully secured reed fascines. Their constructive features showed closest agreement with those I remembered so well from the fascinating remains of that westernmost extension of the ancient Chinese border wall, or *limes*, which I first traced and explored in 1907 in the desert of Tun-huang. A rapid inspection soon convinced me that we had struck the fortified *castrum* which had served as a *point d'appui* for Chinese missions and troops where they first reached Lou-lan territory, after



FIG. 11—Camels with baggage and ice loads crossing salt-encrusted bed of ancient Lop-nor. (Hassan Akhun on extreme right.)

having crossed the salt-encrusted dry bed of the ancient Lop Lake and skirted its absolutely barren northern shores. A variety of antiquarian observations makes it certain that this fortified station dated, like the Tun-huang *limes* itself, from the first military advance of the Chinese into the Tarim Basin, about 104 B. C., and that it represented the bridgehead, as it were, of the desert route by which that advance was made possible.

The walls, from 12 to 18 feet thick at their base and in most places still standing over 10 feet in height, had nowhere been seriously breached, while the open ground outside had been scooped out and lowered to as much as 20 feet below the original level, as marked by the foot of the ramparts. In the interior, some of the beams scattered in utter confusion were fully a foot across and still over 25 feet in length.

Ascending the rampart at daybreak next morning a striking view opened out before me as the sun rose. To the north and northeast in the distance showed strings of reddish-brown *meshas*, bold clay terraces of great height rising in island-like isolation along what looked like the shore of a salt-encrusted dry sea. The ground separating us from the nearest among them seemed to have been worn down by the wind with fair uniformity, and what *yardangs* there were looked low. To the west and southwest a dismal maze of erosion ridges and trenches met the eye. But eastwards the view ranged unbroken over a vast grayish-white plain of salt, unending in its flatness like the ocean in a calm. It was the flat bed of the ancient dried-up Lop Lake and of the fresh-water lagoons and marshes which must once have fringed it on this side during early historical times.

AN ANCIENT LOOKOUT POST

The *mesha* nearest to the northeast was the one which by its bold castle-like outlines had attracted Afrazgul's attention on his reconnaissance march from the south and on which he had traced remains of human occupation. A three miles' tramp across low *yardangs* and salt-encrusted patches brought us to it. With steeply eroded slopes the long and narrow clay ridge rose before us to a height of over a hundred feet (Fig. 7). The strata of clay composing it showed almost vertical faces along the longer sides and at its sharp northeastern point, thus rendering access possible only from the southwestern end, where the *mesha* tapered away in easy steps.

The northeastern end of the ridge, which was its highest portion and about 30 yards wide on the top, had been separated from the rest and turned into a small fort by a massive wall of clay blocks built across on the southwest. A deep trench cut into the hard clay, about 6 feet wide, ran in front of the wall and helped to protect the only accessible side of the stronghold. The gateway leading into it still showed its timber framework, and in one of the rooms which had been built against the protecting wall the big roughly cut beams of wild poplar wood which once supported the roof remained *in situ*. A small heap of oat straw we found here was of importance as proving that cultivation of some sort must have extended even to this vicinity. Refuse of reed straw and horse and cow dung thickly covered the floor in two other rooms, and from here we recovered a variety of interesting small finds. Besides remains of rough household implements in wood, such as a fire block, as well as a thin ring in gold, these included some records on wood and paper, both in Chinese and in that early Indian language written in Kharoshthi which my previous discoveries prove to have been in official use even in this distant part of the Tarim Basin during the first centuries of our era.

A MUMMY 1600 YEARS OLD

Everything indicated that the fortified top of the *mesha* had served as a stronghold and lookout post for some petty chief of the indigenous population of Lou-lan. Of the physical type and simple semi-nomadic ways of the Lou-lan people, as the Chinese found them on the first opening of the route through the desert, the Han annals have preserved some curious notes. The accuracy of these was illustrated in a most striking fashion by the examination of the graves which we found covering the central portion of the ridge. The very first grave we opened furnished vivid glimpses of a phase of human existence which seemed to have vanished as completely as had living nature itself for long centuries from this land of the dead. But they were striking enough to stir the stolid Loplik diggers into a state of undisguised trepidation. Under five pieces of excellently preserved cowhide lay the coffin as sound as when first made. It was formed by two solid halves of a *toghrak* trunk, hollowed out to serve as sides, with two smaller pieces for headboard and footboard. Above and resting on the side trunks were placed seven closely fitting top boards. When these were carefully removed one after the other by Sadik, a young Loplik whom the hope of "treasure" and the promise of a special reward had induced to pluck up courage for this and similar tasks, we saw before us the body of a young man, absolutely intact as it had been buried certainly not less than sixteen hundred years ago.

The face and the headdress were exposed, as well as the feet cased in short boots of red leather. A large cloak made of a coarse but well-woven brown woolen fabric enveloped the rest of the body. On the head was a conical felt cap decorated with narrow circular bands of red braid and an aigrette of feathers. Attached to the top of the cap were tassels made up of some small animals' tails. Small jug-shaped baskets excellently woven with patterns in different-colored straw held remains of foodstuffs which still await close examination, like the rest of the relics brought away from this and other sites. Tied up near one edge of the cloak was a small packet of crushed leaves, no doubt intended, like the contents of the baskets, to provide the dead with creature comforts in another existence. Pins of hard wood fastened the garment in front, and when this was loosened and thrown back we found the body quite bare but for a loin cloth made up of a close-set row of thick tassels in brown wool. Feathered arrow shafts lay by the side of the body. The features were distinctly non-Mongolian, recalling that *Homo alpinus* type, widespread in Europe, which still supplies the prevalent element in the racial constitution of the indigenous population of Chinese Turkestan and which in Asia is seen in its purest form among the Iranian-speaking hillmen near the Pamirs.

It was a strange sensation to look upon this and other figures which still retained the semblance of life and to feel oneself brought face to face with people who inhabited, and no doubt liked, this dreary Lop-nor region in the

first centuries of our era. Everything about them indicated a race of semi-nomadic hunters and herdsmen, as the Chinese annals describe the people of Lou-lan. In spite of the trade route which Chinese enterprise opened through the areas of riverine jungle and marshland serving them for their chase, their fishing, and their pasture, they had evidently clung to their time-honored ways and retained their distinct if primitive civilization.

The general appearance of those old Lou-lan men whom our *ketmans* had for a brief span of time brought again to the light of the sun seemed curiously to accord with the significant juxtaposition in which small bronze objects of Chinese origin were picked up on the slope below the little fort together with stone implements of various sorts, including a jade celt. Elsewhere, too, I came upon indications suggesting that the interval separating the latest Neolithic period in Lou-lan from the first advent of the Chinese may not have been a long one.

Our survey proved that the Lou-lan site, the fortified station, and the stronghold on the *mesha*, all lay along a straight line leading due northeast. It seemed a clear indication that the ancient Chinese trade route I was anxious to trace onwards followed the same direction.

START FOR THE NORTHERN EDGE OF THE LOP DESERT

On the morning of February 17 we started on our return to the Lou-lan base camp, still pursued by the violent *buran*, or sandstorm, which had overtaken us in the fortified station, to which we had returned the previous afternoon upon the completion of our work on the *mesha*. Fortunately the storm abated by midday, and we were able to reach the Lou-lan base by nightfall. Here I found Lal Singh safely arrived after accomplishing all his survey tasks in the west and along the "Dry River" beds on a circuit of some 400 miles.

After paying off my Loplik laborers and sending them back to the world of the living, we started out the next morning to carry out the remainder of the journey we had proposed for ourselves in the Lop region. With our united and yet much reduced caravan Lal Singh and myself first moved to the Kuruk-tagh, in order to secure for our hard-ried camels a few days' real rest with water and grazing at the salt springs of Altmish-bulak. The route we followed for a day and a half to the northwest took us across an endless succession of *yardangs*, broken only here and there by dry branches of the ancient river bed. On this utterly desolate ground we again met traces of occupation in early historical times. Where we struck the foot of the bare gravel glacis stretching down from the disintegrated red hill chain of the outermost Kuruk-tagh, I was able to examine two small burial grounds which Lal Singh had first discovered. They unmistakably belonged to the period when the riverine belt below, now dried up and eroded, had been followed by the ancient Chinese trade route.

Thence we turned to the east and, guided by Abdur Rahim, who knew

the ground here from his expeditions after wild camels, skirted the foot of the Kuruk-tagh. Tramping across absolutely bare slopes of detritus and low rocky ridges showing an extreme state of disintegration, it needed imagination to feel that one was near "mountains." And yet after many days spent over drift sand, wind-eroded clay, and *shōr* the hard going seemed a welcome change to the feet. But even more welcome was it when at last by the evening of February 20 we arrived at the tiny oasis of Altmish-bulak. There was little to please the eye in the small area of dusty tamarisk scrub and salty reed beds, scarcely more than half a mile across anywhere, nestling on the western side of a vast barren basin worn



FIG. 12—Wind-eroded clay terraces (*meshas*), 80-100 feet high, near foot of gravel glaciis of Kuruk-tagh.

out by dry flood beds. Yet, after the dead world we had toiled in, this little patch of vegetation seemed truly delightful to us humans, and I rejoiced at what it meant for our brave camels. The least brackish of its half-a-dozen small springs gave them their first real drink for three weeks, and from the reed beds around they could gather fresh strength for the hard task which still lay before them.

DEPARTURE ON JOURNEY TO TRACE ANCIENT CHINESE TRADE ROUTE

After four days of rest we left the little oasis on the morning of February 25 in two columns for our respective tasks. The one allotted to Lal Singh was to survey the unknown northeastern shores of the great salt-encrusted basin which represents the fullest extension of the dried-up ancient Lop-nor, and the barren hill ranges of the Kuruk-tagh overlooking them. The well of Kum-kuduk was fixed as the place where he was to rejoin or await me. I myself, accompanied by Afrazgul and Shams Din,

proposed to search for the ancient Chinese trade route where it left the edge of the once inhabited Lou-lan area and to trace it over whatever ground it might have crossed, right through to where it was likely to have diverged from the line followed by the modern caravan track which leads from Tun-huang along the southern shore of the great dried-up Lop Lake towards Miram.

The task was after my own heart, combining geographical and historical interest, and of singular fascination. But I could not disguise from myself the serious difficulties and risks which were bound to attend it. From what I knew of the general character of the ground before us it was certain that we could not hope for water, nor over most of it for fuel to melt our ice with, before striking the Tun-huang caravan track, a matter of some ten days' hard marching, judging from the distance indicated by our previous surveys. There was a limit to the endurance of our brave camels; for with the heavy loads of ice, fuel, provisions, and Chinese silver which had to be carried for safety's sake, I could not expect the animals, already hard tried by the preceding work in absolute desert, to remain fit for more than ten or twelve days.

Physical difficulties soon presented themselves after we had descended for some 10 miles from Altmish-bulak southeastward to the edge of the bare gravel glacié. Beyond it we struck line after line of wall-like clay terraces, up to 60 feet in height and more, all eroded by the same east-northeast wind which had sculptured the usual *yardangs* of the Lou-lan area, but obviously of far greater age. It was difficult to thread a way practicable for the camels through or across them without prolonged search or détours. Even more trying for the camels was the ground to be crossed between these long rows of *meshas*. Here we encountered a succession of ridges, far less elevated and of soft outlines, but coated with a hard crust of salt-impregnated clay which caused pain and soon lesions, too, to the feet of the camels. It was a surface formation that was new to me but by no means welcome as a foretaste of what we might find farther on. It seemed quite a relief when these horrible salt-encrusted hummocks gave way at last to mere *yardangs* of the usual type. In the red light of the evening the rows of high *meshas* we continued to encounter assumed a fantastic appearance, like bastioned walls of some huge circumvallation. We had not covered more than 17 miles when the manifest fatigue of the camels obliged us to halt by nightfall. For the first time the dead wood to be picked up around for fuel was extremely scanty and had to be supplemented from the store we carried, limited as that was.

Next morning I got the men to rise at 4 o'clock, which assured a start with the laden camels soon after daybreak. As we crossed what proved the last of the strings of *meshas* and ascended the highest for a lookout, the sharp eyes of Afrazgul sighted far away to the south the big isolated ridge which bore the remains of the indigenous stronghold and cemetery we had

explored on February 17. My intention had been to strike the *mesha* to the northeast of it, where Afrazgul on his reconnaissance of the same day had found surface traces of human occupation, and to make this the starting point for the search of the line which the ancient route had once followed onwards. Soon this point, too, was picked up, and, though the ground with its hard salt-impregnated clay lumps continued to try the camels' feet badly, it was reached by noon. Here, to my disgust at the time, camp had to be pitched for the day. One of our camels had broken down a mile or two before and refused to move on though its load had been distributed among others.

The examination of the remains on the *mesha* below which we had halted did not detain me long. They proved to be those of an outlying indigenous camping place. Reed bundles mixed with cow dung, pieces of simple matting, burnt pieces of wood in a small hollow once used for a fireplace, rags of a sheepskin coat, and the like were all that wind erosion had allowed to survive on the top and slopes of the *mesha*. A Neolithic arrowhead and a few similar relics were subsequently picked up below. More significant than these modest remains was the fact that the ridge which had served for this camping place lay, as the plane-table showed, exactly in the line that led from the Lou-lan site through the ruined *point d'appui* and the indigenous petty chief's stronghold northeastward. The fact agreed well with my previous conjecture that the initial bearing of the ancient route we were endeavoring to trace lay to the northeast. But there was obvious need for more definite confirmation; and so I was eager to use the time left by our halt for a careful reconnaissance of the ground ahead.

IDENTIFICATION OF ROUTE BY ANCIENT WATCHTOWER

Sending Afrazgul to examine a group of *meshas* which showed north-northeast, I myself set out with Tokhta Akhun for an isolated high clay ridge sighted to N. 60° E. As I approached it, after a three miles' tramp over ground where the last traces of ancient vegetation gradually died away, I noticed on the highest portion of the ridge something dark which looked like the remnant of a wall foundation. But I scarcely ventured to believe my eyes until I had eagerly clambered up the steep *mesha* from the southwest, the only accessible side, and beheld before me layers of carefully fastened tamarisk fascines stretching for over 20 feet along the narrow top of the ridge. Far-advanced erosion had pared the long sides of the ridge so much that the substructure of fascines was reduced to only 7 or 8 feet in width. Yet enough remained to convince me that the methods of construction and the original dimensions were exactly the same as in many of the ruined watchtowers I had examined along the ancient Chinese *limes* in the desert of Tun-huang.

Familiar as I had become with those ruins of Han times I could not

feel any doubt about the character and origin of the structure, however badly eroded, which had once crowned the ridge. It must have been a watchtower built by the Chinese, like the previously discovered terminal *castrum*, probably over two thousand years ago when the route to Lou-lan was first opened and the *limes* itself carried forward towards the Lop Desert. Perched on the high *mesha* that marked the extreme eastern edge of the once habitable area, this lonely tower must have served as a landmark for the traffic that passed by during centuries. A small heap of refuse which had survived in a sheltered hollow just below the foundation contained burnt chips of tamarisk and *toghrak* wood and was definite indication of the tower's having been occupied by watchmen.

DIFFICULTIES OF TRAVELING FOR CAMELS

This discovery gave the desired confirmation as to the direction of our onward move, and my elation was great. Afrazgul was able to share it when he came to join me, having on his own side found nothing but a single badly eroded grave on a *mesha*, with a skeleton. On my return to camp I found that Hassan Akhun, my camel factotum, had safely brought in the ailing camel after "re-soling" two of its feet, the pads of which had become lacerated by the first day's terrible going over the fissured hard crust of salt.

Other camels' feet also had suffered and become sore. So Hassan Akhun and the other camel-men were busy till nightfall over re-soling them. It was a painful process for the poor beasts, however beneficial in its results, this sewing on of small pieces of thick oxhide to the live skin so as to protect the sore places. Then came in the evening the almost equally troublesome business of giving the camels their draft of rapeseed oil, which Hassan considered it requisite to administer now every second night in order to keep up their stamina. He called it "the camel's tea," and I knew well from previous desert journeys what excellent effect this provision of oil had on camels when subjected to prolonged deprivation of grazing and water. But it was not easy to make the poor beasts swallow it. Only by holding up their heads firmly in spite of violent struggles and by pouring the half pint or so of rancid oil in repeated small doses down their noses could success be assured; and, as the operation was a long one with the more self-willed beasts, Hassan Akhun and his myrmidons were kept hard at work most of the night.

DEFINITION OF ROUTE BY FINDS OF COINS AND ARROWHEADS

Next morning we started at the break of dawn into the desert north-eastwards. Buoyed up as I was by the discovery of the watchtower, I could not disguise from myself the perplexities which were likely to meet us ahead. I knew that we had now reached the extreme eastern limit of the

area to which the waters of the Kuruk-darya had once carried life. Beyond this there would be no chance of ruins to guide us. The desert eastwards was even in ancient times as devoid of plant and animal life of any sort as it is now. As we left behind the withered and bleached fragments of the last dead tamarisk trunk lying on the salt soil, I felt that we had passed from the land of the dead into ground that never knew life—except on the route to be tracked. The contrast was so impressive that we felt almost regret at taking leave of the former. I little foresaw at the time



FIG. 13—Sir Aurel Stein's party at Miran. (Sir Aurel Stein in middle. On left R. B. Lal Singh and Ibrahim Beg, on right surveyor Afrazgul Khan, seated; Jasvant Singh, Rajput follower, and Muza Akhun, Yarkand caravan man, behind.)

that, as we steered onwards by the compass across absolutely barren wastes of clayey *shōr*, hard crumpled salt or detritus, chance would help us in a way which at times might well seem uncanny.

The first thrilling incident occurred that very morning. We had passed the ridge bearing the remnants of the ancient watchtower, and the last traces of dead desert vegetation were far behind us, when suddenly we found the ancient track plainly marked for about 30 yards by over two hundred Chinese copper coins strewing the ground of salt-encrusted clay among quite low *yardangs*. They lay along a well-defined line running northeast to southwest and about three or four feet across, just as if some kindly spirit among those old Chinese wayfarers who had faced this awful route with its hardships and perils wished to assure us that the bearing we were steering by was the right one. In reality the coins must have

got loose from the string which tied them, and gradually dropped out unobserved through a small opening in their bag or case. They were all of the type common under the Early Han dynasty and seemed fresh from the mint, with rims and legends clear and sharp. Only 8 pieces out of 211 picked up were broken.

Some fifty yards farther on in the same direction we came upon a similar scattered heap of bronze arrowheads, all manifestly unused and looking as if newly issued from an arsenal of Han times. The way in which several were found sticking closely together proved that they, too, had been packed tightly in a bag or case. Their shape and weight exactly agreed with the ancient Han ammunition that I had often picked up along the *limes* of Tun-huang, which was garrisoned during the first century before and after Christ and which is frequently mentioned in the Chinese military records I had recovered from its ruined watchtowers. The way in which the coins and arrowheads remained on the ground suggests that they had dropped from some convoy of stores which was moving at nighttime, probably a little off the main track but still in the right direction. They may well have got lost sight of on the sand then covering the salt-encrusted ground—some sand still remained now between the *yardangs*—until progressive deflation caused them to sink to the *shōr* crust below from which I picked them up so many centuries later.

OTHER EVIDENCES OF THE ROUTE

Next day's long march started auspiciously with the reassuring find of a Han coin, picked up within half a mile of our camp, and about six miles farther on brought a discovery that was both stirring and useful. We had followed our northeasterly course across easy ground of bare clay and mica detritus when it approached at a slant a forbidding belt of salt-coated erosion terraces. These clearly represented the type to which the Chinese of Han times applied the graphic designation of "white dragon mounds" as mentioned in an early account of the ancient desert route to Lou-lan. It was an exciting moment when my eyes fell upon a well-preserved dagger of steel, ten inches long and fitted with a crossbar, lying apart on the slope. In this forbidding desolation it was a dramatic surprise to receive such striking confirmation of our still being on the ancient route. As I examined these relics which travelers separated from us by so many centuries had left behind, all sense of time seemed effaced.

But there was more than a mere romantic interest in the find. It was clear that the terrace had served as a regular halting place, because at its foot was the first piece of ground, level and fairly clear of salt, which travelers would strike after passing through the forbidding maze of "white dragon mounds" and the dried-up lake bed beyond. I had to decide whether I was to strike across the latter or to skirt the ancient lake shore by steering a more northerly course, which threatened to take us farther

away from where we hoped to find water. As I suspected and as Lal Singh's survey subsequently proved, it would have meant a *détour* of days, and the interpretation I put on our lucky find encouraged me to avoid this by heading east for the dead salt lake.

Soon the ground grew difficult, being covered with crumpled-up cakes of hard salt; and when we actually reached the belt of the salt-encrusted "white dragon mounds" progress with the camels was possible only by keeping to the line of these dismal hillocks. Fortunately the salt crust of the depressions between them grew softer after a few miles, and finally a tongue of flat ground with a clay surface but slightly salt-encrusted allowed us to resume the bearing due east and to complete a long and tiring day's march in comparative comfort. At last a line of salt-coated terraces was sighted in front, and this time we greeted the "white dragon mounds" gratefully as marking our approach to "land;" but it took long hours to reach them.

THE MARGIN OF THE ANCIENT LAKE BED

When we reached the first patch of soft brownish salt overlying coarse sandy soil just in front of the salt-covered ridges, indicating as it were the opposite seashore, and we could halt for a night's rest, I had good reason to feel glad for my choice of route and grateful for the lucky find which had prompted it. The following marches, as well as Lal Singh's experience on his route farther north, proved that we had crossed the forbidding sea of hard crumpled salt on the very line where it was narrowest, thus escaping a couple of nights' halt on ground where neither beast nor man could have found a spot to lie down in comfort. It was, no doubt, this advantage which had determined the old Chinese pioneers with their keen eye for all topographical features in the choice of this line for their route.

All the same our night's rest was far from cheerful. A bitter northeast wind cut through the warmest furs and wraps. The camels showed signs of feeling sadly the pinch of hunger.

Fortunately the worst of the desert crossing now lay behind us. The ends of a series of low barren hill ranges were sighted to the east. Far away to the southeast I thought I could recognize through my glasses a bold hill crest which I remembered from our survey of 1907 as overlooking the easternmost portion of the ancient Lop lake bed where the track from Miran towards Tun-huang skirts it. Steering in this direction we wound our way for miles through strings of salt-coated terraces, all running northeast to southwest with depressions of hard salt crust between. Trying as the going was it seemed easy after the previous day's experience, and gradually the parallel ridges grew farther apart, with the bare clay between now exposed and undergoing erosion. At last after about ten miles they disappeared altogether, and an open plain of decomposed clay and mica lay before us, stretching down glacis-like from the hill foot eastwards.

Absolutely barren as the ground was it seemed quite a treat for our eyes. The camels, too, felt the comforting change and stepped out as they had not done for days. We had marched on gaily for a few miles when finds of copper coins of the Han type and of glass beads cropped up in rapid succession. It was most encouraging to receive fresh assurance that the line we were following was that of the ancient route.

Our march of March 3 took us steadily south-southeast in the direction of the previously noticed bold group of peaks with which the western end of the southernmost hill chain of the Kuruk-tagh juts out into the basin of the ancient Lop Lake. The salt-encrusted flat surface of the latter was seen on our right stretching away unbroken to the horizon. In order to avoid any of its inlets, which might have caused fresh trouble to our poor camels, we kept well up on the stony glaciis formed by decomposed low ridges along the foot of the hills. It was by no means smooth going, but what a comfort it seemed to tread again real stones! The ancient route must have skirted the dried-up salt sea more closely; for we came upon no relics of ancient traffic that day. In the evening we descended to fairly level ground by the old shore line. The ground crossed all day was still absolutely barren, without a trace of even dead vegetation. Yet close to where we camped, after a twenty-one mile tramp, we noticed a wild camel's track among the low ridges of detritus.

THE EASTWARD ARM OF LOP NOR

After a night most of which was spent in administering oil to the camels I had to rouse the men by 3:30 next morning. The animals were beginning to show plainly how much they suffered from hunger, and even with loads greatly diminished it became obvious that a timely arrival at grazing and water had to be effected by long marches. Continuing due south for some miles we came into full view of the dead salt lake where it extends a wide arm eastward along the foot of the hill range the end of which we had steered for. We now turned southeast and were after a couple of miles suddenly brought up by precipitous clay cliffs rising some 120 feet above the edge of the ancient lake shore, here stretching from west to east. It was a striking view which here opened out before us. The ancient petrified sea, with its brownish salt crust upheaved into countless small billows, stretched away on the south and southwest unbroken to the horizon, without any thing to distract attention from its impressive uniformity and grim grandeur. There were no strings of "white dragon mounds" hugging the shore line nor any *meshas* looming in the distance.

I knew that this big arm of the ancient Lop Lake grew narrower eastwards; and as the position of Kum-kuduk, computed from our previous surveys, was still far away to the southeast, it was better to keep east along the shore line we had struck and thus reduce the distance to be covered across the trying bed of hard salt. A narrow strip of gravel-covered fore-

shore at the foot of the cliffs, to which we managed to bring down the camels, fortunately offered an easy line of progress. As we skirted this shore line under steep cliffs, projecting in places into eroded bold bluffs and looking exactly like those of a sea still in being, I had the satisfaction of finding clear evidence of the ancient traffic that once moved along here in the shape of small ornaments in stone and bronze which were picked up in succession.

DISCOVERY OF A STILL PRESERVED STRETCH OF THE ANCIENT ROAD

We had marched some fifteen miles from camp when almost simultaneously Tokhta Akhun's attention and my own were attracted by a narrow but unmistakable old track impressed in the gravel by the side of a wild camel's recent footprints. It was very puzzling at first and almost uncanny, since Tokhta Akhun's experience knew of wild camels following the same regular track only where it leads to water or grazing, and of these there was certainly none now behind us. Had wild camels trodden down this path at a period when some vegetation still grew along the shore line farther west? Or could they possibly have taken to following here a track, first made by man but long since abandoned by him, for the sake of easier approach across the dead salt sea to grazing along the Kuruk-darya before it completely dried up?

But soon my eyes were to meet a sight far more decisive in its evidence. We had followed the wild camel's track for about a mile and then lost it where the shore line curved inwards to the north, leaving a wide bay covered with a hard crust of salt. Wishing if possible to save the camels a big *détour*, I moved straight ahead to a hillock rising from the western side of the bay about twenty feet, in the hope of finding the surface easier beyond. In this I was disappointed. But, when I had ascended the salt-coated hillock and looked around, my eye was caught at once by an absolutely straight line running right across from the western end of the bay to the headland which I had sighted before as its eastern end. It was the long-sought-for ancient road, preserved here in all the clearness which the salt-encrusted ground could assure. It was a stirring sensation as I looked down on its broad straight line and then, after determining its direction by plane-table, marched along it for nearly two miles. Close examination showed that the road had a uniform width of 20 or 21 feet and was worn down to a depth of about one foot in the surface of hard salt cakes, as a result of the passage during centuries of transport animals and probably carts too. Its surface, owing to a soft crust covering most of the underlying hard cakes of salt, offered far easier going than the ground adjoining on either side. There was ocular evidence here of the magnitude of the traffic which had once moved through these forbidding solitudes. But how those patient old Chinese organizers of transport had maintained it over some 150 miles without water, grazing, or fuel still remained somewhat of a problem.

Beyond the bay the narrow old track reappeared on the foreshore, which now widened and became sandy in places. For about half a mile it ran close along a raised bank some 20 feet wide at its top, a fact which at the time puzzled me greatly. Subsequent observations elsewhere have led me to conjecture that it may mark the alignment of an ancient canal by which the engineers of Han times seem to have endeavored to carry water from the terminal basin of the Su-lo River as far as possible westwards.

END OF THE DESERT JOURNEY

We started late next morning to let the camels enjoy what scanty grazing there was. But as we moved on by the line of shore cliffs eastward the patches of reeds grew wider, tamarisks dead and living appeared on their familiar sand cones, and finally we came upon hardy scrub and thorns thriving in what to our desert-trained eyes almost seemed luxuriance. We halted after a short march, all of us feeling the need of a rest and glad to let the camels enjoy a good feed at leisure. The concession made to men and animals brought antiquarian reward, too, for me; for Tokhta Akhun, when searching in the evening the high bare cliffs of clay above camp, discovered in a small cavelike shelter a quantity of ancient potsherds and an iron buckle dating back, by the evidence of its ornamentation, to the period of the Lou-lan ruins. So to the last relics of the ancient traffic kept by us.

On the morning of March 6 we were off by daybreak, as I hoped by one long march to cross the arm of the dead lake and strike the well of Kum-kuduk on the caravan track towards Tun-huang, fixed upon as our rendezvous. From the top of a high clay terrace some two miles beyond our camp I sighted far away to the south-southeast a line of tower-like *meshas* which, raised by refraction above the true horizon, quivered phantom-like in the white haze. Their bearing coincided exactly with the position which my survey of 1907 showed for the group of big *meshas* I remembered to have passed on my approach to Kum-kuduk by the route from Miran. So towards them we steered straight across the wide expanse. The ground was trying enough, and in places patches of actual salt marsh were now met with which threatened to embog our camels and necessitated great détours (Fig. 10). But even the camels seemed to feel encouragement from the nearness of the goal, and at last after fifteen miles' struggle we struck sandy ground near the northernmost of the *meshas*. A little beyond I could lead the men to their great joy on to the lonely track where footprints of camels, ponies, and donkeys assured them that they had truly reached the "big road" from Miran to Tun-huang. Their Odyssey in the unknown wastes was ended.

COTTON GROWING IN SOUTH AMERICA

By GEORGE McCUTCHEON McBRIDE

As the most largely used textile, the greatest staple of international trade, cotton has a prime geographical interest from the mere magnitude of its place in human affairs.¹ The peculiar features of its distribution add greatly to that interest. The cotton plant is of very ancient cultivation, but only during the last century has it attained its great relative importance. Although cotton in its natural state is widely distributed, commercial cotton is produced in restricted areas. Of the world's production three-fifths comes from the United States, nine-tenths of the remainder from China, India, Egypt, and Russia (Turkestan and Transcaucasia). But only the United States, India, and Egypt produce for export. The supply for the world's market is thus virtually an Anglo-American monopoly.

Concerning the distribution of cotton as a commercial crop two questions arise. How can the area devoted to cotton be increased to keep pace with the ever-increasing demand for cotton? How can the distribution be extended that the dangers of dependence on so restricted sources of supply may be avoided? Since the American Civil War the industrial countries of Europe have been concerned with these questions, more especially in recent years, as the activities of the British Cotton Growing Association (founded in 1902) and the similar organizations of France (1903) and Germany (1900) bear witness.²

Cotton, in the wild state, is a plant of the tropics and subtropics—of the warm regions with summer rains and a succeeding dry season. Under cultivation the range is extended, in particular under irrigation. At present cultivation is largely limited to the regions near the northerly climatic limit in North America and Asia. In the search for new fields Africa and South America, presenting the bulk of the land surface within the tropics and subtropics, naturally invite attention. Both continents offer hopes for the future extension of the cultivation. In Africa interest concentrates on the Sudan. The various railroad schemes for tapping the heretofore inaccessible resources of this naturally productive region point to extensive possibilities of cotton growing. The irrigable lands of the Niger bend, for instance, are compared with Egypt. Such expansion will be chiefly to the profit of France and Britain. In contrast South America offers possibilities in countries politically independent, a circumstance that has already awakened wide interest. Efforts to increase production here are

¹ See the article "Cotton and Human Affairs" by Mr. McBride in the March, 1920, number of the *Journal of Geography*.—EDIT. NOTE.

² Alfred Renouard: L'évolution cotonnière américaine et ses conséquences pour l'Europe, *La Nature*, No. 2372, 1919, Sept. 13, pp. 170-174.



FIG. 1. (For sources, see bottom of opposite page.)

being made in earnest, and it seems opportune to present a study of the situation as it now appears.

Cotton is grown in every South American country, yet only two—Brazil and Peru—produce it on a commercial scale; and their output is almost negligible in the world's total. In 1915 Brazil produced 1.3 per cent of the world's supply of commercial cotton, Peru little more than one-third of this amount. Obviously this is not the limit of possibilities, which we now proceed to examine in detail.

Cotton in Peru: A Desert Crop

A particular geographical interest is attached to cotton production in Peru. Long before the arrival of the Spaniards, cotton was an important cultivation. It had given rise, in fact, to the highest expression of indigenous culture, the textile art, in which, as numerous specimens show, the ancient Peruvians excelled. Today this art has been lost; but cotton cultivation, long fallen into serious neglect, has lately had a notable revival.

In Peru, as in Egypt, cotton is a desert crop. The Andean highlands are too cold, the eastern slopes of the mountains in general too humid for the plant to thrive.³ But in the third physiographic region of the country, that of the arid coastal belt, it finds its suitable sunny habitat.

To the traveler along the Pacific steamer routes the west coast appears an unbroken, brown desert, impossible of cultivation. On landing at some desolate little port whose corrugated iron structures seem but the temporary shelter of nomadic prospectors or engineers, it is with great surprise that he finds the wharves piled high with bales of cotton or bags of sugar and rice. The town itself is barren. The hills at the back are treeless. Water is peddled in the streets and sold by the pailful. A narrow-gage railway running up along a valley seems to lead only deeper into the desert. Following such a railway line for a few leagues from any port one comes into a flat-bottomed gorge where fields are green with growing crops. Clustered huts of workmen, hamlets of small tradesmen, even little cities, lie hidden in these oases, seldom, however, encroaching upon the irrigable soil of the valley floor but strung out along the sharply defined edge of the desert at the foot of the bordering slopes.

Irrigation is made possible here by the streams that flow from the Andes for at least a part of the year. Many of these streams never reach the sea. Other rivers—even intermittent brooks are indiscriminately styled

³ Cotton is grown on the sheltered floors of some of the valleys of the *montaña*, but as regards commercial production they are impossibly remote.

SOURCES FOR THE MAP, FIG. 1—For Brazil, the state products maps published by the *Secção de Geographia Agrícola* of the *Sociedade Nacional de Agricultura*, 1908; for Argentina, *Estadística Agrícola*, 1916-1917, *Minist. de Agric.*, Buenos Aires, 1918, p. 22; *Agricultural and Pastoral Census of Argentina in 1908*, Buenos Aires, 1909, Vol. 2, pp. 435-436, Vol. 3, pp. 400-402; *The Argentine Year Book*, 1915-1916, Buenos Aires, pp. 232-234; for Peru, the references cited in footnotes 4 and 6; for the other countries, scattered information.

ríos in this parched land—empty into the ocean during a few months of the year. Very few are perennial. Irrigation can be carried on along narrow strips that border the channels, but only at certain seasons, though the soil is a deep alluvium and yields well where water is available. The near-by deposits of guano supply a cheap and abundant fertilizer. It is in such spots that the important cotton-producing areas of Peru are located.⁴

VARIETIES GROWN

The native plant grown before the Spanish conquest is still widely cultivated. The fiber of this native species, of which two main subvarieties are cultivated, is rough and long and is highly prized for mixing with wool or for use in imitation woolen fabrics. Native Peruvian cotton is not planted anew each season but lives for several seasons, even attaining a life of twenty years. In the warmer valleys, where the plants reach the greatest age, stalks sometimes grow to be from 10 to 15 feet high. The best fiber comes from plants not more than four or five years old. Another native variety grows wild in some parts of the country but is not cultivated. Foreign cotton has also been introduced and forms more than 50 per cent of the present production. The so-called "Egyptian" cotton from the United States is the most popular. It grows more rapidly but does not live so long and cannot stand drought so well, hence it is cultivated chiefly in the valleys best supplied with water. The price it commands is not so high as that of the native fiber and is subject to greater fluctuations, but its yield per acre is considerably greater than that of the Peruvian plant.

DISTRIBUTION

Eighteen of the Peruvian coast valleys produce cotton for export, but the following seven stand out above the others: Piura and Chira in the north; Chancay and Cañete in the department of Lima; Ica, Chincha, and Pisco in the department of Ica in the south. The principal factor that controls the time of planting, and consequently of picking, is neither the seasonal variation of temperature, which, in fact, is very slight, nor local rainfall—as we have remarked, entirely lacking in most of these valleys—but the arrival of water in the dry stream beds.

In the far north of Peru, in the valley of Piura, equatorial rains occasionally cross the sharply defined northern border of the desert. The inhabitants expect a wet season about every seven years. The rain then falls continuously for several days at a time. These years are the "good years," *años buenos*, for cotton then may be grown on land long unused. Plants put in the ground at that time yield several crops without further rain and without irrigation.⁵ The exports at Paita, the chief port of this

⁴ A detailed description of how the textile is grown may be found in the official Peruvian publication, *Boletín del Ministerio de Fomento*, Vol. 14, No. 1, pp. 25-94.

⁵ A. F. Sears: *The Coast Desert of Peru*, *Bull. Amer. Geogr. Soc.*, Vol. 27, 1895, pp. 256-271.

region, are considerably increased during these "good years." Cotton raised thus is called *algodón de lluvia* (rain cotton) to distinguish it from that cultivated with irrigation.

In the usual dry years in the valley of Piura the ground must be ready for planting before water arrives in the river channels. The soil is well soaked then and the cotton planted. Water generally reaches the valley at Piura in January or February when the equatorial rains are falling in the interior and the mountain snows are melting fast. A limited amount of water is then available during some three months, after which none can be had until the following year. Picking time comes during June, July, and August. Newly planted fields yield their first crop after about eight months' growth. A second crop may be gathered shortly after Christmas, but growers usually find it more profitable not to endanger the plants by interrupting the process of irrigation at that time and so pick but once a year. Some cotton is being picked, however, during almost the entire year in valleys where the native plant is grown.

In the series of valleys near Lima, those of Chillón, Rímac, Chancay, Huacho, Pativilca, Santa, Lurín, Mala, Cañete, Chíncha, and Pisco, Egyptian (upland) cotton is grown more largely than the native species. Of these valleys, Chíncha is the most productive. Here the heat is modified by winds from the sea. The soil is deep. So porous is the sandy ground, however, that it is difficult to secure sufficient water for irrigation. Consequently after the soil has been well soaked in February and March the surface is pulverized to prevent escape of the precious liquid. Planting then comes in May or June, and the crop is picked about the first of the following May. In the upper part of the valley, where water arrives earlier, planting at times is done in October. Even if planting is done during December and January a good crop may be harvested in July and August.

Pisco valley is more fortunate in having a permanent water supply. Beginning with October there is an abundance throughout the entire summer. There is even enough in this river to allow some to be "lost in the ocean." Here planting takes place in October or November, considered by all the most favorable season, since the plants become large enough by February to shade the ground from the extreme heat of that month. Egyptian cotton is here the favorite variety. The stalks, cut close to the ground after each crop, bear for four or five years before dying. The native plant is not cut but continues to bear on the same stalk for several seasons.

In the valley of Ica, farther south, where water is extremely scarce, native cotton is grown almost exclusively. At times several years pass without enough water for irrigation in the lower valley, and one watering a year is sufficient for a good crop. The soil is sandy, the water sinks deep into the ground, and many schemes are resorted to in order to secure the underground supply.



FIG. 2



FIG. 3

FIG. 2—A typical cotton field in Minas Geraes, Brazil. The depressions between hills or mountains, the lower part of mountain sides, and the land along the banks of small rivers are the places most frequently utilized. (Courtesy of Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce.)

FIG. 3—Picking cotton at the Piracicaba Agricultural School, São Paulo, Brazil. (Courtesy of the Pan American Union.)



FIG. 4



FIG. 5

FIG. 4—Cotton trees at São Joaquim (Santa Catharina?), thirty-five years old and still producing. They were cut back every other year.

FIG. 5—A cotton farm near Coroatá on the Rio Itapicuri, Maranhão, Brazil, showing the appearance of a field in October. The condition seen explains, in part, the reason for poor grades in Maranhão cotton. (Figs. 4 and 5 courtesy of Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce.)

PRODUCTION AND DESTINATION OF PERUVIAN COTTON

While the greater portion of the Peruvian cotton is shipped to England and the United States, there are several textile factories in the country that handle a part of the crop. Most of these mills are located at or near Lima. They produce the coarser fabrics in demand at the local markets. A quite modern mill, partly operated by electricity, has been opened recently in Arequipa, and here some of the cotton from the southern valleys is made into cloth, largely for the homely needs of the Bolivian and Peruvian highland populations. The cotton produced in Peru is usually ginned near where it is grown, and, because of the scarcity of wood and coal, cottonseed is used for fuel in the gin engines.

LABOR

Labor is an old problem in the Peruvian coast valleys. In colonial days it was solved in part by the importation of negroes. When the negro slaves were freed in the middle of the last century dependence was placed on Chinese laborers, and many coolies were introduced. Later Chinese immigration was stopped, and its place has not been filled, though a number of Japanese have entered the country. As most of the colonizable land of the coast valleys pertains to large estates there is little hope of attracting European labor, and chief dependence must still be placed on the Indian population. Peons are attached to most of the large estates. The peons, who are virtually serfs, are not free to hire out on other farms. As no estate can support a very large number of peons there is frequently a scarcity of labor at the short season during which irrigation is possible. There are few towns or cities or even densely populated rural districts from which labor can be recruited. In places a transfer of workmen between upland vineyard and coastal cotton lands has been possible. When, as often happens, the vintage season coincides with the arrival of the water in the late summer, a double shortage of labor is experienced. Indians from the high sierras descend to some of the valleys for the planting or picking season, returning immediately thereafter to their cool mountain homes. Some landowners have been forced to adopt a plan of renting on shares, either to their own peons or to free laborers whom such offers would attract. This, however, is not so profitable to the landlord as the favorite Latin-American peon system inherited from colonial times.

TRANSPORTATION

In the isolated Peruvian valleys the problem of reaching a market is often a vexing one. Miles of desert separate centers of production from the towns. The lower parts of the valleys are in some cases absolutely barren, affording no sites suitable for the location of settlements. Railroads, however, have now tapped all of the principal valleys, and tiny ports line

the Peruvian coast to handle the produce of the valley oases. Human carriers, mules, and donkeys move the cotton in small bales to railway points. Cheaply constructed coastwise steamers (*caleteras*) touch at the various ports, collecting produce and carrying it to the more important points where ocean liners load it for export.

Official estimates place the cotton yield of the entire republic for the 1915-1916 season at 27,600 metric tons.⁶ This is not an impressive amount—it leaves Peru tenth among the cotton-growing countries of the world⁷—but it shows good and hopeful progress.

POSSIBILITIES OF INCREASED PRODUCTION

At present there are about 140,000 acres planted in cotton. This amount is being increased steadily and is capable of a still greater extension. The districts of Chira and Pisco offer the greatest possibilities, since they are well supplied with water. Besides the valley floors, to which the present cultivation is almost entirely limited, there are considerable areas of interfluvial grounds that will produce when water is brought to them. Foreign capital is needed for this enterprise. Given modern systems of irrigation and some solution of the labor problem, perhaps by increased use of mechanical aids, this desert coast of Peru, with its ideal climatic conditions, should easily multiply its yield many times and contribute an appreciable part of the world's cotton, though it offers no such possibilities as do the extensive uplands of Brazil or the plains of northern Argentina.

Brazil

Cotton was used in Brazil before the arrival of the Portuguese (1500), though it was not under cultivation, as in Peru. The Indians employed its fiber to make cords for their bows, to weave sleeping nets (*hamacas*), and even to make the scanty clothing which the climate required. During colonial times the Portuguese developed the industry, cultivating cotton and establishing textile factories. In the absence of coin, cotton thread and cloth were circulated as money in some parts of the colony. As negro slavery became more general the cultivation of cotton grew, and, by the end of the eighteenth century, Brazil ranked as one of the foremost cotton-producing countries of the world. Maranhão, Pernambuco, Bahia, Rio de Janeiro, and Pará all figured prominently among the ports from which the raw material was shipped. Brazilian cotton, at this period, formed about 8 per cent of the amount used in English mills and supplied the principal stock of the finer qualities. So profitable was the production that cotton was transported from far inland on the backs of mules, the journey

⁶ C. R. Paz: *Estadística de la industria algodonera en el Perú, año 1915-1916*, abstracted in the *West Coast Leader*, May 5, 1917, Lima.

⁷ Cotton Production and Distribution, Season of 1915-16, *U. S. Bur. of the Census Bull.* 134, Washington, D. C., 1916.

sometimes requiring several months. The invention of the gin in 1793 made North American competition too keen for less progressive Brazil, and her proportion of the world's trade gradually diminished, though the production for home consumption continued to be considerable. When the Southern ports were blockaded during the Civil War, Brazil again came to the front as a source of supply for European mills, but the boom was short-lived. Since that time Brazilian cotton has been consumed largely by local factories. Little of it enters European trade, though probably more is raised now than at any previous time in the history of the country.

DISTRIBUTION

The cotton plant grows wild or cultivated over the entire republic. Branner reported in 1885 that he had seen it growing in nearly every province and cites authorities to show that it is raised, at least on a small scale, from the Araguay in Brazilian Guiana to Porto Alegre in Rio Grande do Sul, along the Amazon, the Tapajoz, the Madeira, the Rio Negro, in the Matto Grosso region, and along the upper waters of the Paraguay.⁸ Production for commercial purposes, however, is limited almost entirely to the states along the northeastern coast, a small district west of the city of São Paulo, and a few localities among the hills of Minas Geraes. In the northeastern angle of Brazil the coastal plain, though often very narrow, at places attains a width of 100 miles or more. The cultivated areas of this strip, as also of the lowest river valleys, are devoted chiefly to the production of sugar. They are too moist for cotton culture.

Back of this coastal belt, at a distance which varies from 30 to 200 miles, the land rises to a height of several hundred feet. A greatly broken surface, some 500 feet or more in elevation, interrupted in places by higher remnants of ancient mountain ranges, extends far inland toward the low basin of the Amazon and Paraguay river systems. This upland is known by various names in Brazil, according to the amount and character of its vegetation. The plateau consists for the most part of open woodland in the better-watered sections, great areas of bush country, and vast stretches of prairie. Few dense forests are found. Over the entire high interior there are marked rainy and dry seasons, most of the precipitation taking place in the summer months, while the winter is clear and dry. During the dry winters trees lose their leaves and grass dries up except in the more favored regions; but there is little change of temperature from month to month.

It is on the seaward margin of the plateau that both coffee and cotton have been extensively cultivated. Coffee production has centered in the states of São Paulo, Rio de Janeiro, and the southern part of Minas Geraes. Cotton growing is distributed chiefly on the highlands that border the

⁸ J. C. Branner: Cotton in the Empire of Brazil, *U. S. Dept. of Agric. (Miscellaneous) Special Report No. 8*, Washington, D. C., 1885.

coastal belt farther north in the states of Bahia, Sergipe, Alagoas, Pernambuco, Parahyba, Rio Grande do Norte, Piauí, Ceará, and Maranhão. It is seldom found below the 500-foot contour, or above the 2,000-foot line.

While the coastal belt, with the exception of that part lying between latitude 3° and 5° S., has abundant rain (40 to 60 inches), the interior, where the bulk of the cotton is grown, falls within the climatic division of the semi-arid northeast. Here large areas have a rainfall averaging 15 inches or less, marked furthermore by irregularity from year to year. The droughts of Ceará are notorious for the wholesale depopulation occasioned through famine and migration. The drought of 1877-1879 was the most disastrous, as it came after years of prosperity during which the acreage devoted to cotton was greatly increased. In the region liable to drought a sure basis for increased cultivation must depend on irrigation by storage, work which is now under progress. Droughts apart, the climate is excellently suited for cotton cultivation.

The landward limit of the cotton belt of northeastern Brazil is fixed more by accessibility to markets than by climate, since general meteorological conditions vary but little over the Brazilian plateau.⁹ In the São Paulo region, where coffee and cotton enter into competition, meteorological factors are influential. The frosts of the winter of 1918, for instance, worked serious havoc in the coffee plantations. To replace their loss planters have been tempted to turn to cotton as a crop yielding a quick return.

The character of the soil is also a factor determining the division of the cultivated areas on the higher lands between coffee and cotton. In the coffee district the soil is a dark red diabase, rich in iron, and when rains set in everything becomes covered with sticky red earth. The soil is said to be peculiarly suited to coffee production. On the other hand, cotton is generally grown on the soils formed from the great sandstone and limestone deposits which characterize a large part of the northeastern uplands and the valley of the São Francisco.

METHODS OF CULTIVATION AND VARIETIES GROWN

Modern methods of cultivation are practically unknown over most of Brazil. Cotton is grown chiefly on small farms and in about the same manner as it was two hundred years ago. The timber or bush is cut and allowed to lie until thoroughly dried; then it is burned, and the cotton is planted among the stumps and charred logs, with almost no effort to break the ground. Planting takes place when the first rains come and hence varies from December to April or May, being earliest in the north and on the higher grounds. The crop is picked as it matures. Picking sometimes extends throughout the dry season. This circumstance has given

⁹ The best descriptions of the climate of Brazil are contained in C. M. D. de Carvalho's "*Climatologie du Brésil*," London, 1916, and in his "*Météorologie du Brésil*," London, 1917 (reviewed in *Geogr. Rev.*, Vol. 4, 1917, p. 411).

the impression that there is more than one crop a year; but Branner, after investigation, asserts that such is not the case in any part of the country.¹⁰

As in other South American countries the tree cotton, mostly indigenous, is cultivated extensively, especially upon the drier regions of the uplands. This hardy plant grows for many years, though it seldom yields well for more than two or three. Its fiber is long and silky. The annual herbaceous varieties require more moisture and more careful cultivation but produce a larger quantity of fiber. Sea Island plants have also been introduced with good results in a few regions where the water supply is more abundant. The *arboreo* is of slow growth, bearing a crop only after from nine to twelve months, while the *herbaceo* requires but six to mature.

PRODUCTION

Export figures fail to reveal the production of cotton in Brazil because, as in China, the fiber grown has been consumed almost entirely within the country. An extremely high import duty, 7.27 cents per pound, has tended to keep out foreign raw material and has fostered home manufacture. There are now over two hundred mills manufacturing cloth. A decided stimulus to this industry has been felt since the beginning of the war, scarcity of British manufactured textiles having forced Brazil to depend more upon her own output. It is only within recent time that the by-products have been considered, but cottonseed is now being utilized by presses in São Paulo to such an extent that the importation of cottonseed oil has almost entirely ceased.

EFFORTS TO ENCOURAGE PRODUCTION

In recent years the cultivation of cotton has been encouraged through the official Servicio do Algodão (now under the direction of an American expert). Great efforts are being made not only to render Brazil independent of foreign raw material but, by stimulating the textile industry, to place the country among the world's large exporters of cotton and cotton goods.¹¹ During the months of May and June, 1918, an exposition of Brazilian textile industries was held in Buenos Aires for the purpose of extending the output of the country's factories in the important markets of that city. As a result of these efforts reports for 1917-1918 show an increased cultivation of cotton in Brazil, and her production was estimated to be about 400,000 bales.¹² A setback to production is the boll weevil, which in late years has become a very serious menace to the Brazilian crop. In 1918 the estimated damage amounted to over \$27,000,000. Alagoas and Ceará suffered most heavily, losing two-thirds of the cotton planted. State

¹⁰ *Op. cit.*, p. 32.

¹¹ *Commerce Repts.*, June 19, 1918, pp. 1078-1080.

¹² *Cotton Growing in Latin America*, U. S. Dept. of Commerce, Latin-American Division, Circular No. 34, Washington, D. C., 1918, and *Commerce Repts.*, June 22, 1918, p. 1127.

and federal governments, however, are taking precautionary measures to check this pest, and, in spite of such losses, larger areas were under cultivation in 1918 than ever before.¹³

POSSIBILITIES

In considering the future of cotton in Brazil those who have studied the situation have used extravagant terms. Branner says: "The territory in Brazil capable of yielding cotton is coextensive with the empire itself." An experienced American expert, after studying the cotton situation there recently reported that "Brazil is a natural cotton country and possesses an ideal climate for this crop. . . . The continued supremacy of the United States in the production of cotton depends wholly upon the continued dormancy of Brazilian agriculture."¹⁴ Others have described Brazil as "potentially the greatest cotton-producing country on earth."¹⁵ As far as climate and soil conditions are concerned production has far from reached its limits. The whole northern section of the plateau varies little in temperature from month to month and, in most sections, receives sufficient moisture during some part of the year to insure a fairly abundant growth of cotton, while the long mild winters, with months of sunshine, few frosts, and no storms, afford favorable maturing and picking seasons. Parts of the lower Amazon basin will probably be found suitable also.

Labor and transportation are the factors that limit the possibilities of largely increased production in the near future. The plateau region is very poorly supplied with navigable streams. Such rivers as the São Francisco and the upper Paraná, while navigable in long stretches of their courses, are impeded by rapids or falls where they descend from the plateau. A gradual extension of railways into the interior will ultimately provide transportation facilities.

As for labor, even the present demands cannot be supplied. Neither the far-reaching raids carried on by the early Paulistas in quest of Indian slaves, nor the importation of large numbers of Africans in colonial times, nor the phenomenal immigration of years immediately preceding the war have provided sufficient workmen for the increasing demands, even of the coffee crop. Owners of *fazendas* (plantations) find it difficult to secure permanent colonists. Each season witnesses a movement of workmen with their families from one farm to another in search of better living conditions. The establishment of factories, too, has attracted many laborers to the cities, and migration from country to town is taking place in Brazil, as everywhere else, to a remarkable extent. But with increase of population and improved means of transportation it seems probable that Brazil will become one of the very important sources from which raw cotton will be exported to the world's markets.

¹³ *Commerce Repts.*, April 4, 1918, p. 49.

¹⁴ *Daily Consular and Trade Repts.*, Sept. 12, 1914, pp. 1391-1392.

¹⁵ *U. S. Dept. of Commerce, Latin-American Division, Circular No. 34, p. 3.*

Argentina, Paraguay, and Lowland Bolivia, Regions Adapted to Cotton Growing

Though as yet scarcely figuring in the world's markets, northern Argentina, with the adjoining parts of Paraguay and Bolivia, has long been looked upon as offering one of the largest available areas for cotton culture. Except in the highlands of the northwest, the climate is sufficiently mild, the temperature is constantly moderate, and the rainfall, which nowhere exceeds 40 inches, occurs mostly in the spring and summer months, the winter season being dry. In this section are situated extensive sugar-cane estates, where rainfall is sufficient, or where, as about Tucumán, irrigation is possible.

So promising were these regions considered for cotton production that in the great shortage of our Civil War an effort was made by British interests to encourage cultivation there. A measure of success was met with in many places, even with the handicap of great distance from market.¹⁶

In 1906 the Argentine Ministry of Agriculture sent an expert to study the provinces of the north with a view to establishing so-called "cotton colonies" there. The report submitted¹⁷ found that most of the low plains in that section of the country and the valleys not higher than 1,000 meters are suitable, in climate and soil, for cotton cultivation. Plants were found growing wild in many places, and cotton growing on a small scale was common. Little progress, however, was made in the establishment of cotton colonies. Until the stimulus of war-time prices production was practically limited to those colonies of the Chaco advantageously situated near Barranqueras, port on the Paraguay. But at present renewed efforts are meeting with greater success. Communities which had been producing textiles only for their domestic consumption have begun to extend the area under cultivation with the hopes of profiting by the high prices offered.¹⁸ In 1916, according to the *Estadística Agrícola* (1916-1917), the area under cotton was 7,500 acres, almost all in the Chaco Territory. The following figures published by the Argentine Department of Agriculture show the area planted in cotton during the season 1918-1919 distributed according to provinces:¹⁹

Corrientes	927 acres
Chaco and Formosa.....	31,061 "
La Rioja, Jujuy, Misiones, etc.....	692 "
Total.....	32,680 acres

¹⁶ See M. G. Mulhall: *The Cotton Fields of Paraguay and Corrientes*, Buenos Aires, 1864.

¹⁷ J. B. Massé: *Rapport sur la création de colonies cotonnières nationales, République Argentine, Annales du Ministère de l'Agric., Sect. Écon., Commerc. et Indust., Vol. 1, No. 1, Buenos Aires, 1906.*

¹⁸ *Commerce Repts.*, March 11, 1918, p. 916.

¹⁹ *Commerce Repts.*, April 22, 1919, p. 495.

EXTENSION OF PRODUCTION

As regards climate and soil this section of northern Argentina, with the similar contiguous regions of Bolivia and Paraguay, offers an area suitable for cotton growing that far exceeds in extent the 30,000,000 acres of the cotton belt in the United States. But the problems of labor and transportation make extensive cotton growing not an immediate possibility. At present sugar is the chief cultivation, and for the sugar estates much of the labor is furnished by Indians from the Chaco of Argentina and Bolivia. This would probably never prove a satisfactory supply for the cotton fields. It is too uncertain and would be too hard to train. But Argentina's phenomenal immigration, if resumed when normal world conditions shall have been re-established, will gradually solve this problem. As for transportation, regular steamer traffic on the Paraguay River simplifies the problem in the east, and the usual South American tendency towards government-owned railroads, built not in response to production already established but rather as a means of developing promising regions, may be counted on ultimately to provide facilities for the interior districts.

Other South American Countries

In former years, when there were no great cotton countries, the Guianas furnished an important percentage of the world's production. In 1827, 16,000 bales were exported from British Guiana. Dutch Guiana at one time supplied the British mills with much of the finer quality used.²⁰ But the regions in which cotton cultivation is possible are very limited. The narrow coastal belt, in many places actually below the level of high tides, is too humid to favor cotton culture, though admirably suited to sugar and rice. The interior uplands, exposed to the northeast trades, receive on their Atlantic slope over 100 inches of rain distributed throughout the year. Farther inland are found extensive savanas, where, because of lighter rainfall, grasslands replace the forests of the Atlantic slope. But over all of these highlands there occur marked changes of temperature that make extensive cotton cultivation unlikely, even when settlements and railroads reach that most inaccessible region.

In Venezuela the district about Valencia is the chief center of cotton cultivation, which is still on a very small scale. The crop is consumed locally, the mills producing a coarse, inferior cloth. In the interior of the country, the great grasslands, the *llanos*, offer many thousands of square miles where cotton might possibly be grown, though the climatic conditions are not sufficiently known to warrant a positive conclusion. This region, too, possesses a scanty population, apparently less numerous now than one hundred years ago, and means of transportation are quite primi-

²⁰ J. A. Todd: *The World's Cotton Crops*, London, 1915, pp. 97, 204.

tive. It must be long before the *llanos* are anything more than a pastoral country.

Colombia's great eastern lowland territories offer similar conditions of climate, soil, and settlement. In her northern provinces, Bolívar, Atlántico, and Magdalena, she produces a small quantity of long staple cotton, some of which is exported while North American raw material is imported for use in her local mills. The lower basin of the Magdalena, to which cotton cultivation is principally limited today, is well suited in climate, soil, and location to become an important center of production.

In Ecuador, over a small area about Guayaquil and in the province of Manabi, some cotton is grown, but very little territory in this country will ever offer a field for its extensive cultivation.

The same may be said of Chile and Uruguay. Chile's northern provinces, where temperature conditions would be favorable, contain little arable soil and almost no water. Her southern sections lie beyond the latitude where cotton can become a staple product. Uruguay, like central and southern Argentina, is subject to sudden and extreme fluctuations of temperature.

Conclusion

The possibility of cotton growing over wide areas in South America has been demonstrated by the success already achieved. Commercial production on a large scale must necessarily depend upon the other factors mentioned as well as upon the suitability of climate and soil. But the problems of labor and transportation are capable of solution—are being solved at the present time in some of the most important sections. South American countries confidently expect that foreign capital will be available for the development of irrigation where that may be required. It would seem that this great, politically independent continent, lying almost entirely within the tropical and subtropical zones, in which cotton exists as an indigenous plant and in which it has been successfully grown in many places and for many centuries, offers a field that is well worth the attention of those who are interested in extending the production of this indispensable fiber. Though not an immediate possibility, it seems safe to predict that the great highlands of Brazil and the plains of northern Argentina, Paraguay, and eastern Bolivia, with the more limited coastal valleys of Peru, may eventually compete with the cotton belt of North America and vie with Egypt, India, and China in supplying the world with its most important item of international trade.

THE PAYS DE MONTBÉLIARD

By PIERRE CHAVANNES

ITS DISTINCTIVE PERSONALITY

The old *pays* of Montbéliard is no longer to be found on political maps of France. When the geometricians of the Revolution split France into fragments, Montbéliard caused a difficulty. It had been united a little while previously, and they tried adding to it Haute Saône, Haut Rhin, and Mont Terrible in succession, for it was Vosgian on the north, Alsatian in the east, and Jurassic on the south. Only in 1816 did the administration solve the problem by dividing it among the three, but even this rough treatment has not destroyed the unity of its people, who know and love their *pays*, recognizing its distinctive personality while none the less playing their part as Frenchmen. The very last invasion, by the welcome American soldiers, showed its sense of the individuality of the *pays*, for the men joined with the villagers in singing, each in his own tongue, the hymns of the American evangelists Moody and Sankey. This Protestantism of Montbéliard is by no means its only distinctive feature. Who that knows the Swiss religious boundaries will need to be told of the many subtle differences that accompany this deep one? The personality of a country is an outcome of a long effort, and, when the struggle is against overwhelming odds, as has been the case with Montbéliard, the maintenance and enrichment of that personality is matter for profitable study. While some districts cannot but develop and maintain a personality, Montbéliard, only twelve leagues by six, seems at first sight cut off from even this possibility. Within its narrow limits are both high plateaus of the Jura and the outposts of the Vosges, while between them lies the open plain.

ITS PHYSICAL DIVERSITY

On the Jura flank we have the chain of the Montagnes du Lomont, with their short sweet grass and their tufts of beech, descending step by step into the busy industrial plain. These steps are built of dry limestone plateaus, where the wild mistletoed pear tree struggles for life on the stony pastures, where bushes of hawthorn and privet and, down below, small woods are the only things that relieve the nudity of the poor grass, easily withered by the sun's rays on these thirsty rocks. But there are green and fertile valleys even here wherever the clays, which hold the water in large subterranean sheets, reach the surface on the flank or at the bottom of the narrow valleys and abundant springs gush out from the rock.

Towards the Vosges the heavy red earth appears, and it gives place in turn to the schists and porphyries and sandstones of the outposts of the

old mountain mass. Here are streams everywhere, and the soil is deep between the rounded hilltops where reign broom and heather and ferns, as they do on the moorlands of Brittany or Limousin.

The plain between the two hill districts is no more unified than they are. Calcareous patches remain in districts that belong really to the north, and the Vosgian rocks show through here and there in the calcareous part of the plain. The calcophile and calcophobe floras carry the same contrast into the realm of life. Towards Luxeuil and Belfort we have red sandstone towns, while Montbéliard is of the beautiful gray stone that gives such a dignity to the old ecclesiastical city of Besançon. And so the contrast works on through all spheres.

ITS CHARACTER AS A GATEWAY

So far from destroying its individuality, the intimacy of these contrasts actually gives the *pays* its character. But it is not only Vosges and Jura that meet in the plain. Alsace penetrates the great Gate of Belfort; the strange course of the Doubs is finally turned towards the Saône and the south; there is contact with Lorraine on the northwest and with Switzerland on the southeast. The plain with all its contacts is the essence of the *pays*, and the two hill borders are, as it were, the lintels of the fateful door through which have streamed for ages, in one direction or another, peoples and armies, races and civilizations, processes and ideas. How can a mere passage land have a personality? Each movement must surely obliterate the work of its predecessors or combine with them to form a mere characterless composite photograph. So it might be were it not for the powers of resistance that human nature manifests, intensifying its character best perhaps in the face of opposition. In this case the great and fateful opposition has been between the Franco-Roman and the Germanic, between the West and the East. The little *pays* has been seized and tossed about many a time, as have all the lands of France's northern aureole between the sea and the Alps; but of old it felt the struggle even more than did its fellows, for it was at the great gate. Its people have had to stand always ready and have learned their lesson of self-dependence, selecting from both sides but remaining true to themselves.

ROMAN CONQUEST AND BARBARIAN INVASION

Such a point of vantage appealed to Roman skill, and, after Caesar's conquest of Sequania, Augustus made a military camp in the *pays* while Agrippa transformed prehistoric tracks into roads for commerce and law and taxes of the empire. His roads can be followed today from the Doubs through the Belfort gate to Basel and the Rhine. Sequania quickly became Gallo-Roman, and the center of the future *pays* was the old Celtic town of Mandure on the Roman road. It was transformed by Agrippa into the Roman city of Epamanduodurum, with forts, temples on its hills, aque-

ducts, arenas, a forum surrounded by portals, and a theater larger than the one at Orange. Under the Romans villas spread along the roads, *coloni* and serfs cleared the valley woodlands and grew wheat, the town became a great market for horses (still reared on the Jura plateaus), the gardens

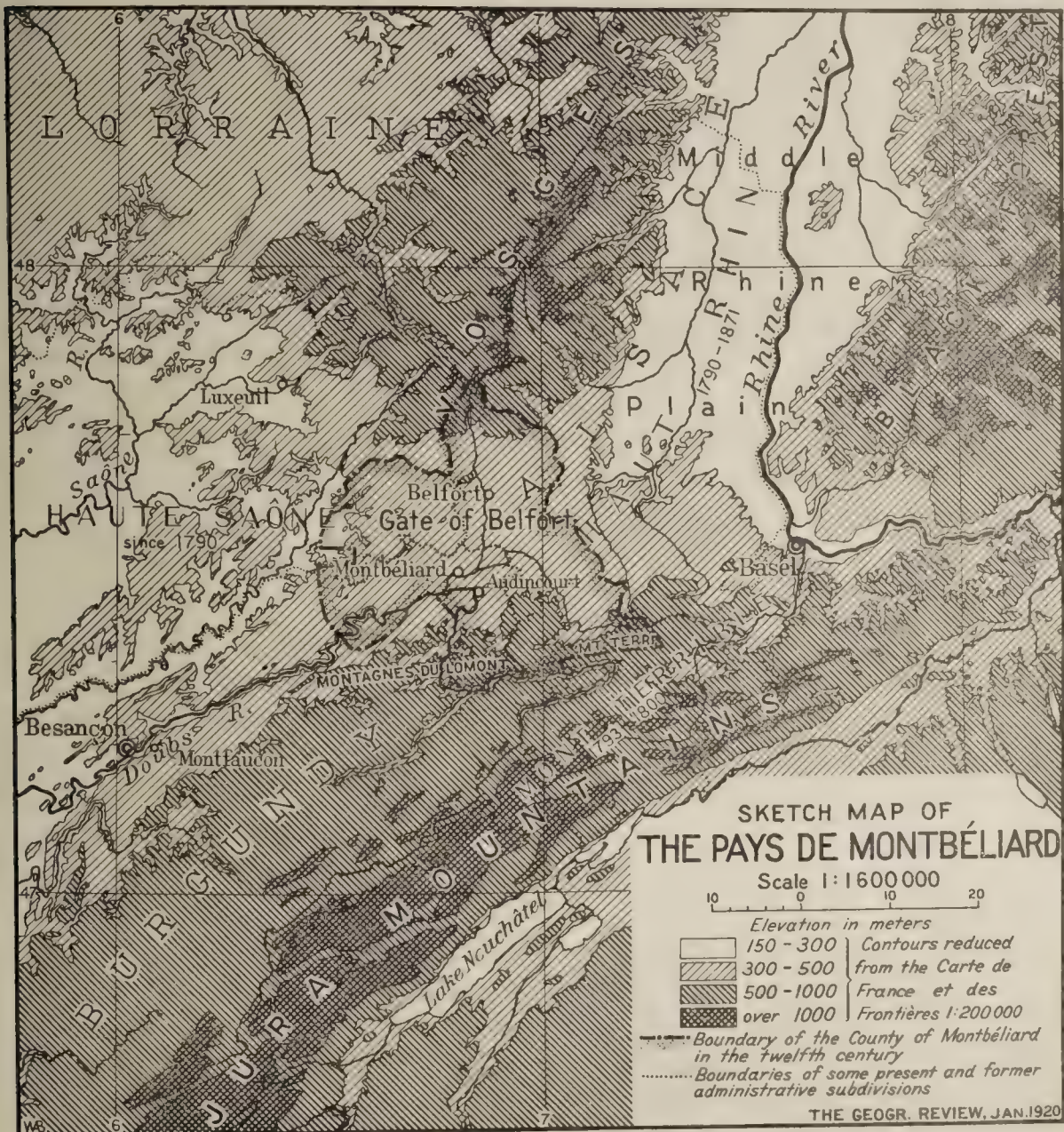


FIG. 1—Sketch map showing the physical features and historical development of the *pays* of Montbéliard. Scale, 1:1,600,000.

The *pays* lies in the Gate of Belfort, the threshold between the Middle Rhine Plain and the Saône-Rhône depression. The County of Montbéliard is shown in its greatest extension, in the twelfth century (based on F. Schrader: *Atlas de Géographie Historique*, Paris, 1911, Pl. 22). The boundaries are also shown, by faint dotted lines, of the present and former French *départements* among which the territory of the County was divided: Haute Saône, unchanged since its establishment in 1790, occupying the upper basin of the Saône; Haut Rhin, 1790-1871, equivalent to Upper Alsace; and Mont Terrible, 1793-1800, practically equivalent to that portion of the present Swiss canton of Bern known as the Bernese Jura (the last based on map of Bishopric of Basel in *Dictionnaire Géographique de la Suisse*, Vol. 1, Neuchâtel, 1902, p. 155, and map of the Helvetian Republic, 1798-1802, *ibid.*, Vol. 5, 1908, facing p. 564). The name of the last *département* was based on a misinterpretation of the name of one of its prominent features, Mont Terri, an arid, limestone ridge of the Jura Mountains (*teri*, dialectical for *tari*, waterless). The retention in some current maps and works of the name Mont Terrible for the ridge does not conform with best usage (*Dict. Géogr. de la Suisse*, Vol. 5, p. 643).

became filled with walnut, chestnut, plum, and cherry, and peach trees which the Romans had brought from Asia, and finally imperial taxation was added to all these gifts, without adding to their charm.

Christianity followed the legions, and Vesontis (Besançon) for a short space became a sort of Christian capital; but the empire was decaying, and the barbarians soon spread through the great gate. Julian strengthened its fortifications, but along lines that made the *pays* thenceforth only an outpost soon to be lost. Then the story is of Burgundians and of Vandals and after them of the terrible Huns who burned Epamanduodurum; it is a story of ever-renewed efforts to remake the barrier after each invasion, until despair set in. The frontier line is the index of history. Then the tyranny of the barbarian chief replaced that of the Roman tax gatherer. Frank succeeded Burgundian, and the *pays* became a part of Elsgau, allocated at the treaty of Verdun to Lothair I and thus brought into the Empire. During long, confused years the old Romanized Celtic indigenous people slowly assimilated its conquerors, taught them its remarkably distinct and pure dialect of the *langue d'ôïl*, though Alsace was Alemannic, and made the Burgundian and Frankish farmer into a sort of rural version of the lord of the Gallo-Roman villa.

ITS RISE TO INDEPENDENCE

The position of Montbéliard gave it a special importance in the days of moving peoples, and, as the movements subsided, it rose for the first time to political unity and independence under Louis de Mousson-Montbéliard, Count of Montbéliard in 1034, and a powerful feudal seigneur. Related to Pope Leo IX and a descendant of Pepin d'Héristal and married to a niece of Hugh Capet, Louis had indeed much to strengthen his position.

The old fight, with the names of France and Burgundy and the Empire to the fore on the one side, and the counts, famous in battle and in pillage, on the other, gravitated for a while towards the Empire; but the accession of the French House of Châlons tilted the scale the other way, and that was continued by the second House of Montfaucon. They were succeeded by the counts of Württemberg, who split away from Burgundy and, under the leadership of Lorraine, helped to ruin Charles the Bold. During these centuries once more, by playing off one power against another in war and diplomacy, the *pays* managed to maintain its virtual independence under the shadowy suzerainty of one or other side.

In the course of the princely wars the bourgeois gradually seized the reins of government and took part against their princes. By these means there arose all along the great war zone from Flanders to Switzerland that strong municipal life that has left us witness of itself in its *hôtels de ville* and its belfries whence the tocsin called men to defend the civic life. In 1283 the citizens of Montbéliard gained a remarkably strong charter freeing them from all dues to the seigneur save a tax of 12 deniers per fathom of house façade.

Eighteen bourgeois were to be elected by their fellows each year, and they in turn chose an executive of nine for judicial and police purposes; so that in this little aristocratic republic the citizens were judged and ruled by their peers. The nine were required to add three other notables to their number when there was very serious business to discuss. The charter shows a curious foretaste of Rousseau, as it were, for it says that the town is ruled by "*le magistrat*," meaning not an individual but the whole governing body considered as a collective personality including over and above the specially elected men the whole of the town's notables. This system lasted on from 1283 to the Revolution, that is 510 years—a sufficient proof of its strength. When Bernard de Saintes announced in 1793 that he brought the town liberty, the chief bourgeois, Ferrand, could well retort that he was mistaken, for they had long known it.

ITS RELIGIOUS HISTORY

History would have been different had Cleopatra's nose been longer, and, if an heiress of Montbéliard in 1397 had been affianced, like her sister, to a French notable and not to Eberhard of Württemberg, the story of religion in the *pays* would probably have worked out very differently, and its character would have been other than it is. Montbéliard, lying in the Gate of Belfort, feels all the winds of heaven, the mild westerlies with their rain alternating with the dry cold winds from the east. Similarly it has felt the four winds of the spirit, the streams of ideas along the great roads of migration used alike by man and bird. It was notably in the stormy sixteenth century that Montbéliard felt the streams of ideas moving between Lyons on the one hand, with its great market and printeries at a safe distance from the repressive Sorbonne, and Strasburg and Basel on the other, or between Geneva on the one side and Lorraine and France on the other. It became early a place of refuge for persecuted French Huguenots, and its Württemberger count Ulrich, who protected the humanist Reuchlin and hated the monks, naturally looked towards Basel, whence were sent Farel and Toussain. These preachers easily roused the people against the decadent Church and gave the Reformation in Montbéliard a strong Calvinistic flavor; but the princes, with their German connections, later modified the religious organization in a Lutheran direction. Protestant Montbéliard accepted the Augsburg Confession and a somewhat episcopal system; but the princes could not drive away the Huguenot intellectuals, and the spirit remains Calvinistic though the form is rather Lutheran. A very similar feature is noticeable in the Channel Islands, for, though Charles II forced them to accept the Act of Uniformity (1661), the Calvinistic spirit retained the leadership, at any rate until the rise of the Oxford movement. The staying power of the Calvinistic spirit has made it a mighty factor in molding not only the Protestant parts of France but also Germany, Holland, Britain, and the United States.

The Protestants of the *pays* in the sixteenth and eighteenth centuries studied for the ministry at Tübingen, and the German element thence derived was of value as contributing a vein of pious mysticism to leaven the theological aridity of the seventeenth century and the rationalistic aridity of the eighteenth. The Moravian influence in Montbéliard, as in many other places, was intimate and quietly powerful, as the wide distribution of the "Sermons de Nordin" in company with the family Bible bears witness.

In the quarrels after the burning of Servetus, Montbéliard took its stand for toleration and for Castellion, who developed an impassioned defense of that principle. Ever since then Protestants of the *pays* have taken a pride in gathering psalms from the Huguenots, chorals from the Lutherans, hymns from America, songs from the latest Welsh revival.

EDUCATION

The Reformation in Montbéliard led to the growth of a system of education with the high ideals characteristic of the Huguenot educators—a system including free tuition and stipends for promising pupils at the Latin school. At the top stood an academy teaching theology, law, and medicine; but, when Louis XIV took the town, he scented an enemy there, and the academy was closed—not, however, until it had conferred on the *pays* almost as clear a superiority as Scotland has so long enjoyed for analogous reasons, a superiority, moreover, which is reappearing under modern conditions of liberty. The Reformation usually also allied itself with the printing press, and Montbéliard undertook the printing of theological works on paper made by mills penetrating into the deep valleys of the Jura.

Discussion naturally promoted initiative, and in the latter half of the seventeenth century Montbéliard took its place in the general agrarian movement of western Europe and made large forest clearings, followed in the next century by the beginnings of nineteenth-century industry.

RELATIONS WITH FRANCE

There is no doubt that Protestantism has been a master factor in the making of the personality of Montbéliard, surrounded as it everywhere is by zealous Catholics; but its Protestantism made less of a breach with France than might be imagined. Some French kings were concerned to maintain good relations with their outposts over against the Empire. Louis XIV, however, was brutal enough until the Treaty of Ryswick made him give up his prey, and the Guises were apt to billet their ill-paid troops on the luckless Protestants and to follow up unchecked outrages by courtly letters of regret. The wars of religion were indeed a bad time for the *pays*, and its people often fled to the forests, even though, as Bohain tells us (1590), the wolves were abundant.

The eighteenth century saw the horrors of those wars grade down into petty legal bullying, and Montbéliard retained its individuality under its prince, whose position at the great gate kept him from degenerating into a comic opera puppet like so many of the other rulers in the minutely divided Germanic lands near the Rhine. His court was a dignified one, as pictured in the memoirs of the Baroness Oberkirch, and to it came thoughtful men of letters and science, the forerunners of the Revolution, which was to attack so formidably the individuality of Montbéliard. Those thinkers, in an atmosphere of education, brought the people of Montbéliard into close sympathy with revolutionary France, though the princes would have preferred to keep the link with Württemberg, the pastors that with Tübingen, and the men of law that with Stuttgart. Montbéliard crystallized out on the French side, Württemberg on the German, and so they naturally drifted apart, though they kept more than one reminiscence of old relationships. The Celtic Gallo-Roman foundation determined the evolution of Montbéliard, the Germanic that of Württemberg. The folklore of the *pays*, for example, is quite Celtic in its ideas about fairies, save that Aunt Aria is partly related to Santa Claus.

The Revolution proclaimed Montbéliard a part of France, one and indivisible; and the sad days of 1870 intensified the people's French patriotism: they had to play once more the part of the outpost. The sculptor Bartholdi has carved a wounded lion in the red sandstone cliff commanding the plain, and at the patriotic festival of July 14 the Alsatians were wont to come to commune with their more fortunate fellow citizens, while, in the place of honor before the Germanic market hall of Montbéliard, is the statue of Denfert Rochereau, "to whom our *pays* owes that it remains French." It has been one of the surprises of 1914-1918 that the German did not dare to attempt the Gate of Belfort; his Belgian crime diverted his energies elsewhere.

EFFECT OF INDUSTRIALISM ON ITS CHARACTER

Nineteenth-century industry has made, as it were, a new region in Montbéliard. Watchmaking, weaving, manufactures of hardware, automobiles, and bicycles have all developed. Many of these industries have been associated with works in Alsace and in Italy, for the purpose of avoiding customs barriers. The influx of Alsatians into the *pays* after 1871 and the spread of Swiss watchmakers and engineers has filled the plain. Men from the hills came down, and workmen arrived from Belgium and from Italy and even from Germany, in the last case mostly to do the rough work the Frenchman hates. None the less, Montbéliard has kept much of the personality it had won from centuries of struggle.

It was an old Huguenot saying that the more blows one aimed at the cause, the more hammers one would break, "*Plus à frapper on s'amuse, tant plus de marteaux on use.*" One may truthfully apply this saying to

the personality of Montbéliard. Like the other Calvinist communities it resisted with the great motto, "In God my strength." That is the actual motto in the coat of arms of the County of Montbéliard, "*En Dieu mon appuy.*" But ages of struggle leave their mark, and we must not expect too much in the way of amiability and social elegance in a country of ancient poverty like Montbéliard. It is true that one finds more of these qualities in Flanders and Alsace, which have suffered much from the tramp of armies, but they are rich lands of grass and corn, almost "lands of increment" when once the forests were cleared. They have their *joie de vivre* far more marked than Montbéliard, and they express it naturally through the fine arts. Montbéliard has a hard climate save in spring, and life is a struggle there. If people gathered of old in its towns it was to defend the great Gate of Belfort, and if its rulers welcomed refugees it was to strengthen themselves, much as the Hohenzollerns welcomed and utilized refugees in seventeenth-century Berlin.

ITS CELEBRITIES

Montbéliard has had some interesting celebrities. Bohain, the naturalist, was a son of Huguenot refugees; von Forstner, the statesman, was a religious refugee from Austria; and there are many others as well. Bohain founded a botanic garden at Montbéliard with strong pharmaceutical leanings, and he was one of the early protagonists of the potato, as well as its scientific godfather. Another celebrity was Georges Cuvier, founder of the science of comparative anatomy.

ITS BOURGEOISIE

The Montbéliard bourgeoisie is a solid one, with good doctors, lawyers, teachers, and capitalists, men who may be a trifle slow but are prudent and thrifty and hardworking. They are inclined to cool rationalism rather than to flights of imagination, and this makes their religion somewhat dull and overweighted with mere common sense. There is not here the vigorous realism of the Fleming, nor the glamorous mist of the spirit of the Rhine. The common folk make first-rate foremen and noncommissioned officers. Many other possibilities in them have been checked by the tyranny of industrialism. The quiet solidity just noted owes a great deal no doubt to former relations with Germany, to years of study at Stuttgart and Tübingen; it is closely analogous to the Swiss characteristics of morality without elegance and honesty without radiance. But the vein of mysticism from the Rhine and the Moravian teachers is there none the less. The Swiss have to some extent stirred up the Montbéliardais to emulate them. A Swiss in 1611 established the first iron foundries in Audincourt, and watchmaking was also brought from Switzerland. Though wars have devastated Montbéliard as sadly as Lorraine and though its historical monuments are mostly in ruin or under ground, yet its higher-grade industries have made its villages less

miserable and its houses less fragile than those of its suffering neighbor. They have something of the spaciousness of Alsatian wealth and Swiss comfort about them, just as the cookery in the *pays* has a foundation of tradition of Franche Comté, with borrowings from Alsace and Lorraine. The people are less reserved and suspicious than the poor of Lorraine and of many other frontier zones, and they have a strong initiative which makes them rather ready to emigrate at need. In the eighteenth century they went to Russia. Later they have gone to the New World, to the United States and, more recently, to Canada and to South America. They are industrial democrats in the Protestant plain, and the villages bordering the Catholic hill country are apt to express their anti-clerical bias with some spirit by ringing the church bells long and loud in celebration of the Fourteenth of July, that the silent and often secretly monarchical Catholics may hear and tremble. None the less they are too moderate of spirit for any chauvinism or aggressive nationalism. They rather love a compromise. Up to the present, socialism has remained theoretical, and here we must allow for the persistence of the individual employer, so often submerged elsewhere by the limited-liability company which has accentuated industrial strife.

The *pays* has many interesting industrial agglomerations along the floors of the Jura valleys. As usual, they have swallowed up old villages and are rather amorphous, but they are not composed of sad rows of tenements like the industrial towns of so many British and even French valleys. Here almost every dwelling stands in its garden, and the buildings are dotted about everywhere without plan or order, though industrialism has killed the old beauty of the peasant's house.

Entering into relations with the whole world, industrial Montbéliard has shown itself akin to other industrial areas in the broad humanitarian sympathies of its people, while growing wealth has given it the opportunity of developing the historic sense. May the pushing back of the old menace in 1918-1919 give the *pays* the chance to use its wealth in exchange of ideas between France and Germany and in pursuit of the links between beauty and truth.

SOME RECENT BOOKS ON MILITARY GEOGRAPHY

By DOUGLAS W. JOHNSON

The reader who finds his way to that shelf in the library set apart for books on military geography will today see it much more heavily laden than in 1914. It may interest him to scan the contents of certain of the more recent additions and to gain an impression of their general scope and value. With little difficulty he can separate the new works on this subject into two classes: those written for the purpose of instructing the soldier in the elements of map reading, topographic sketching, and other military duties more or less geographical in character; and those addressed to that part of the public interested in the broader principles of strategic geography.

MILITARY MANUALS

In the first class belongs a small volume on "Map Reading and Topographical Sketching" by the professor of drawing in the United States Military Academy, Edwin R. Stuart.¹ As would be expected in a book from the pen of an author occupying Professor Stuart's position, the text is clearly written and is illustrated by a good selection of simple diagrams and sketches in addition to one large-scale specimen topographic sheet. Nine chapters are devoted to map reading and treat the usual range of topics, such as map scales, conventional signs, representation of relief by contours and hachures, and methods of orienting and using maps in the field. Then follow four chapters on topographic surveying and sketching and one on panorama sketching. The book is convenient in size and sufficiently complete for its purpose.

The author of a second work on "Map Reading and Panorama Sketching" modestly conceals his identity under the phrase "by an instructor." In size this book does not differ greatly from the one already mentioned, but it covers a somewhat broader field. Half the text (eight chapters) is concerned with map reading, including sections on lettering maps, map enlargement, and topographic sketching. Panorama sketching receives two chapters, while three chapters are given to the prismatic compass and its uses. Admirable sketches and maps in color combine with the well-arranged text to make a most creditable little book.

Less can be said in favor of Captain Barber's "Military Map Reading and Intelligence Training."³ The book is of convenient pocket size and

¹ E. R. Stuart: *Map Reading and Topographical Sketching*, xi and 139 pp.; maps, diagrs., ill. McGraw-Hill Book Co., Inc., New York, 1918. \$1.00. 7½ x 5 inches.

² *Map Reading and Panorama Sketching*. By an instructor. 2nd edit., revised and enlarged. 113 pp., maps, ill., index. Sifton, Praed & Co., Ltd., London, 1917. 4s. 6d. 7½ x 5½ inches.

³ C. D. A. Barber: *[Military] Map Reading and Intelligence Training*. 179 pp.; maps, diagrs., ill. Penton Press Co., Cleveland, 1917. \$2.50. 7 x 4½ inches.

contains some very good sketch maps reproduced in colors; but the text is a strange mixture of unnecessary detail, childishly simple discussions or explanations, and technical descriptions. "Intelligence Training" gives the author latitude to the author's pen, and we read about bomb throwing, how to play games, trajectories of bullets, care of the feet, types of rifles, three ways to crawl on the ground, and other equally related topics. The so-called "Preface" is but a table of contents without page numbers, while only two out of the first twenty-one plates are numbered, and those two apparently wrongly so. As the text contains many cross references to plates by number, and as the unnumbered plates are often without title or any suggestion as to what they represent, the reader is hopelessly baffled. Add the facts that the style is crude and the grammatical construction of the text far from being above criticism, and one is justified in wondering how the book ever came to be published in its present form.

Bryant and Hughes' "Map Work"⁴ is a larger volume than any of those previously mentioned and covers a wider range of topics than its title would indicate. The first chapter, for example, discusses elementary principles of mechanical drawing and land surveying, and there are chapters on the uses of the compass, on panorama sketching, and on the methods of making and reporting military reconnaissances. For the rest the usual topics are treated, such as map scales and conventional signs, methods of representing relief, the processes of map making from triangulation through plane-table traversing to contouring, and the principles of map reading. One appendix contains lists of suggested problems and exercises for each chapter, while two others give descriptions of instruments and an explanation of the use of the theodolite. The illustrations are good, and the subject matter is well arranged.

STUDENTS ARMY TRAINING CORPS TEXTBOOK

One is tempted to place in a class by itself a more pretentious work on "Military Geology and Topography,"⁵ the joint product of eighteen geologists and geographers collaborating under the editorship of Professor H. E. Gregory. Those who have knowledge of the valuable services rendered by Major T. E. David, chief geologist of the British Expeditionary Force, and his assistants; by Colonel A. H. Brooks, geologist of the American Expeditionary Force, and his staff; by the seventy or more geologists attached to the German armies; and by other geologists and physiographers actively engaged during the world war in making earth science the ally of military science, will have no doubt of the urgent need of instructing army officers in the principles of geology as well as in topography. They, at least, will

⁴ V. S. Bryant and T. H. Hughes: *Map Work*. 174 pp.; maps, diagrs., ill. Clarendon Press, Oxford, 1918. 5s. 9 x 6½ inches.

⁵ H. E. Gregory, edit.: *Military Geology and Topography: A Presentation of Certain Phases of Geology, Geography and Topography for Military Purposes*. Prepared and issued under the auspices of the Division of Geology and Geography, National Research Council. xv and 281 pp.; maps, diagrs., s., index. Yale University Press, New Haven, 1918. \$1.25. 9 x 6 inches.

appreciate that a serious textbook on "Military Geology and Topography" should prove most useful in the educational program of any institution giving courses in military training.

When the Students Army Training Corps was established the need for such a textbook became pressing, and the Division of Geology and Geography of the National Research Council undertook to meet the need by enlisting the services of many experts in the two sciences. The volume which resulted may perhaps suffer in some degree from its multiple authorship and from the further fact that it was prepared quickly to meet a national emergency; yet it must take a high place as the most serious attempt ever made to focus the attention of military men upon those facts and principles of geological and geographical science which have proved to be applicable to military problems. There are chapters on rocks, rock structures, and their representation by means of geological maps; on rock weathering and soils; on rivers, lakes, and swamps and their uses in military operations; on the geological conditions of water supply; on plains, plateaus, mountains, and other land forms and the effect of their peculiar topography on warfare; on map reading and, still more important, on the interpretation of land forms as represented by maps; and a final chapter on the economic and military uses of minerals. The book contains over one hundred illustrations, including excellent series of block diagrams by Frederick K. Morris and Armin K. Lobeck. It is a good kind of book and the best of its kind.

BOOKS ON STRATEGIC GEOGRAPHY

Among recent books on the broader subject of strategic geography are two small volumes by the British author, Dr. Vaughan Cornish. When the war broke out, Dr. Cornish offered his services as an instructor in geography to assist in training the new British armies by delivering lectures to officers at the various camps and training centers. The promptness with which the army authorities accepted his offer, less than three weeks after war was declared, indicates that they attached much value to geographical training. Later the Admiralty accepted a similar offer from Dr. Cornish, and altogether some ten thousand military officers and a large number of naval officers listened to lectures on the topics which are briefly treated in a little book of short essays entitled "Naval and Military Geography of the British Empire."⁶

The essays cover a wide range of subjects, the group classified under naval geography including discussions of the strategic position of the North Sea in relation to the Atlantic routes, Ireland as the key to Great Britain's naval communications, the relation of British and German North Sea bases, the great sea route via the Suez Canal which forms the geographical axis

⁶ Vaughan Cornish: *Naval and Military Geography of the British Empire (Considered in Relation to the War with Germany)*. Lectures given during 1914-16 to officers of the navy and army. viii and 140 pp. maps, ill., index. Hugh Rees, Ltd., London, 1916. 8½ x 5½ inches.

f the British Empire, and Britain's control of the Indian Ocean by possession of its dominating country, India.

The section on military geography includes topics equally varied, from the strategic geography of the Cologne-Essen district, and the belt of territory from Holland to Calais lying between this vital area and England, to the geographic features of Bulgaria and Serbia, which operated as topographic defenses on both sides of the Orient railway route, and the nodal point Constantinople, the strategic importance of which today, as so often in the past, renders it difficult for the Great European Powers to decide its fate.

Many of Dr. Cornish's essays are disappointingly short and superficial. Thus Constantinople receives but two and a half small pages of large type, and Egypt, strategically one of the dominating positions in the world, but three pages. What the author does say is so interesting and suggestive that we wish he had gone farther and deeper.

The same author's "Strategic Geography of the Great Powers,"⁷ based upon a single lecture delivered on the flagships of the Grand Fleet and elsewhere, describes the resources in men and material of each of the Great Powers, the distribution of these resources and the facilities for concentrating them at strategic points, and the foreign positions which flank the lines of communication by which such concentration is necessarily effected. Here we find a somewhat fuller treatment of the strategic value of the Constantinople region than is given in his other book. The strategic geography of the Turkish Empire is considered in connection with Germany's grandiose scheme of a Teutonic state reaching from the North Sea to the Persian Gulf, and Germany itself is treated so as to portray its strategic situation in case it should conquer *Mitteleuropa*. In this respect the book deals with a past possibility which already begins to seem remote. Of present value, however, is the author's warning against the menace of an alliance between Russia and Germany, doubly dangerous because of the supplementary character of their respective military and economic resources.

The American will read with special interest Dr. Cornish's ideas on the remarkably favorable strategic situation of the United States and on the high strategic value of the Panama Canal and its natural defenses. He makes an interesting comparison with the Suez Canal and notes that the tropical forests flanking the Panama Canal are barriers against land armies just as truly as are the deserts east and west of the Suez waterway; while a blockade by sea is enormously difficult because two simultaneous operations on a large scale would be required. Dr. Cornish points the way to a fascinating field which must some day be covered in an exhaustive treatise on the strategic geography of the United States and her possessions.

⁷ Vaughan Cornish: *The Strategic Geography of the Great Powers* (based on a lecture delivered during 1917 to officers of the Grand Fleet and of the British armies in France). viii and 114 pp.; maps, index. George Philip & Son, Ltd., London, 1918. 2s. 7 x 5 inches.

GEOGRAPHICAL RECORD

AMERICAN GEOGRAPHICAL SOCIETY

Meetings of November, December, and January. The first meeting of the American Geographical Society for the season of 1919-20 was held on November 25 at the Engineering Societies' Building, 29 West Thirty-ninth Street. President Greenough presided. He submitted for confirmation the names of 145 candidates for Fellowship, each of whom had been approved by the Council, and they were confirmed as Fellows of the Society. Thereupon Mr. Frederic Dean addressed the Society on "Siam's Place in the World." The new flag of Siam was displayed on the platform.

During December and January meetings were held at the Engineering Societies' Building on the following dates: December 9, December 23, January 6, and January 20. At all of the meetings President Greenough presided. At the monthly meeting of December 23, 125 candidates were confirmed as Fellows of the Society; at the annual meeting on January 20 the number was 37. The Society was addressed at these meetings by the following persons: December 9, by Miss Florence Parbury, on "Kashmir, the Garden of the East"; December 23, by Mr. Robert J. Flaherty, whose accounts, in the June and August, 1918, numbers of the *Geographical Review*, of his exploration of the Belcher Islands in Hudson Bay and his traverses across Ungava Peninsula will be remembered, on "Hudson Bay and Its Natives," illustrated by motion pictures; January 6, by Dr. Charles Upson Clark, director of the School of Classical Studies of the American Academy in Rome, on "Greater Rumania"; January 20, by Professor Clarence H. Young, of Columbia University, on "Picturesque Byways of Greece." Prior to the address on December 23, the Cullum Geographical Medal of the Society was presented to Professor Henry Fairfield Osborn, president of the board of trustees of the American Museum of Natural History. An account of the presentation, as well as the text of the annual reports of the Society, read at the meeting on January 20, will be found immediately below.

Presentation of the Cullum Geographical Medal to Professor Henry Fairfield Osborn. At the monthly meeting of the American Geographical Society on December 23, at the Engineering Societies' Building, 29 West Thirty-ninth Street, the Cullum Geographical Medal of the Society was presented to Professor Henry Fairfield Osborn, the eminent paleontologist and president of the board of trustees of the American Museum of Natural History. In presenting the medal, President Greenough, who presided at the meeting, spoke as follows:

"It is my pleasing duty tonight to bestow your gold medal upon a distinguished recipient. In the past we have often given similar recognition of service rendered to geographical science but, I think, never to any one quite so intimately associated with the life and learning of this metropolis. The impress left by his endeavors upon the opportunity for knowledge in this city will endure long after all of us are gone. Let me read the inscription upon the medal:

TO
HENRY FAIRFIELD OSBORN
FOR HIS REVELATIONS
OF THE LIFE AND ART OF THE
MEN OF THE OLD STONE AGE
AND
IN RECOGNITION OF HIS SERVICE TO GEOGRAPHICAL EDUCATION
THROUGH THE AMERICAN MUSEUM OF NATURAL HISTORY
1919

"Geography claims within its province the study of man as affected by environment no less than of other forms of development of the earth's surface. Both heads of the inscription, therefore, are germane to our Society, and in the person of our guest we honor alike the author and the administrator. He has been, moreover, a leading student of the paleogeography of North America in its relations to that of Eurasia. I wish that it were possible to dwell here upon his story of the cave men, preserved and revealed by the discovery of their dwellings, decorated with surprising pictures of contemporary animal life. Suffice it to say that the narrative is enthralling and the argument is conclusive of the existence and art of a race dating back to a period so ancient that the pyramids seem only of yesterday by comparison.

"And what shall I say of the great museum of which our guest is the head and

which occupies easily the first place in the world amongst undertakings of its character? He has sent expeditions into every country and has gathered from them specimens of every form of life for the free instruction of our people. No citizen of New York can fail to thrill with pride as he views the admirable results of the administration and its unique addition to the attractions of this city, interpreting by the light of science vestiges of a remote past in which our own country is so prolific.

“And now, Sir, permit me to ask your acceptance of this memorial of the admiration and esteem of our Society, accompanied by the wish that you may long continue the valued labors which have already so notably enriched our community.”

After the acceptance of the medal by Professor Osborn, Mr. Robert J. Flaherty addressed the Society on “Hudson Bay and Its Natives,” as referred to above.

Annual Reports of the Society. At the annual meeting of the American Geographical Society held on January 20 at the Engineering Societies' Building, 29 West Thirty-ninth Street, the annual reports of the Council, of the Treasurer, and of the Special Committee were read, as follows:

REPORT OF THE COUNCIL

January 15, 1920

To the Fellows of the American Geographical Society:

In reviewing the past year the Society may feel satisfaction in the knowledge of substantial service rendered by it to the United States Government and of usefulness to its members, notwithstanding certain difficulties caused by labor troubles and general economic disturbances. Reference was made in the last annual report to services in connection with the so-called Inquiry, organized by the Department of State to prepare information for use by the Peace Conference. The matter assembled by the joint efforts of the agencies concerned in the Inquiry proved of the greatest use at the European conference. Our Director, Dr. Bowman, accompanied the Commission to Paris and was employed there during the first five months of the year in affairs of great consequence, and again, after his return to America in June, he was summoned abroad in September for a further service of three months. The value of the assistance rendered by the Society has been suitably acknowledged by the Department of State, and the whole episode will constitute a permanent monument in the history of the organization.

Another assignment by the Department of State, second only in importance to the service at Paris, was declared when the Society was requested to conduct an economic survey of territory in dispute between the states of Guatemala and Honduras, involving their respective boundary limits. The Secretary of State, having been asked to use his good offices in this international complication, suggested the aid of our Society as a competent and disinterested authority to conduct an economic survey for the purpose of establishing existing facts as a foundation for the desired decision. The designation of our Society in such a capacity is the only instance known to us of the use in this country of a private organization in such an international function. A suitable expedition was organized and conducted by our Society, and our report was submitted to the Department of State. Thus again is illustrated the high consideration enjoyed by our organization amongst competent authorities.

The Council holds very definite views of the scope and importance of the field occupied by the Society as affording opportunity for permanent contributions to the science of geography in a manner and to an extent not covered by any similar association in the country. In the near future the Council may present their views in a more extended statement to all of the Fellows, together with an argument and appeal to those interested.

The regularity of the publication of our various periodicals was seriously interfered with by the printing troubles in New York City, but the indulgence of our Fellows precluded complaint and publication is now approaching regularity. The disorganization and the greatly increased cost of printing has also delayed the appearance of the monographs, mentioned in the last report, but these will be put forward at the earliest practicable moment and, it is believed, will prove interesting and opportune.

The value and interest of our publications has been attested by many communications received, and their highly scientific character has been maintained. They have been as follows: the *Annals of the Association of American Geographers*, an annual publication; the *Geographical Review*, monthly; the *Journal of Geography*, monthly, except for three summer months. The circulation of each shows a marked tendency to increase, very gratifying when the rather technical character of the publications is considered.

Additions to the Library comprise 937 books, 778 pamphlets, 5,500 periodicals, 4,552 maps, and 60 atlases. Our collection now comprises 55,723 books and pamphlets, 46,205 maps, and 922 atlases.

The lectures of the Society have continued to be attended by large numbers, who find

them a source of special interest because of the variety of the topics covered and the high reputation of the lecturers. Addresses were delivered by the following: the late Mr. Theodoor de Booy, Professor Albert Bushnell Hart, Mr. Henry Woodhouse, Professor Alfred G. Mayor, Mr. Herman Montagu Donner, Professor J. Paul Goode, Mr. Jerome Davis, Mr. Frederick Webb Hodge, Mr. Frederic Dean, Miss Florence Parbury, Mr. Robert J. Flaherty.

The number of Fellows at the close of the year was 3,900, of whom 385 were Life Fellows. This shows a falling-off of only 58 in number, which, in view of the influences of the war, must be regarded as indicating a satisfactory condition.

The Society awarded the Cullum Geographical Medal in 1919 as follows:

To Emmanuel de Margerie, director of the Geological Survey of Alsace and Lorraine, for his distinguished work on "La Face de la Terre" and for his contributions to geographical science;

And to Henry Fairfield Osborn, president of the American Museum of Natural History, for his work on the life and art of the Men of the Old Stone Age and in recognition of his service to geographical education through the American Museum of Natural History.

The Society joined with similar organizations at the time of the Roosevelt exercises in the city in exhibiting a collection of maps and souvenirs associated with Colonel Roosevelt's work as an explorer.

The report of the Treasurer submitted herewith gives a summary of the income and expenses of the Society, together with a condensed balance sheet which shows a satisfactory financial position, notwithstanding the difficulties of the time.

The creditable work which has been done during the year is largely attributable to the earnestness and efficiency of the staff, which deserves cordial recognition, in addition to such moderate increases in compensation as the finances of the institution have rendered possible.

Respectfully submitted on behalf of the Council.

John Greenough
Chairman

REPORT OF THE TREASURER FOR 1919

The following is a statement of the receipts and expenses and the condensed balance sheet of the Society as shown by the books on December 31, 1919:

Receipts and Expenses

On December 31, 1918, there was at balance of income account.....	\$1,322.17
During the year there has been received from annual dues, interest on investments, and sales of publications.....	57,324.82
	<hr/> \$58,646.99

There has been expended for salaries, house expenses, library, meetings, publications, postage, insurance, etc.....	\$56,269.85
Balance of income account December 31, 1919.....	<hr/> \$2,377.14

Condensed Balance Sheet

Cash	\$47,077.62	Sundry deposits.....	\$49,427.66
Cash, special deposit.....	6,963.11	Annual dues paid in advance.	1,070.00
		Income account balance.....	2,377.14
		Balance of capital account	
		uninvested	1,165.93
	<hr/> \$54,040.73		<hr/> \$54,040.73

Henry Parish
Treasurer

REPORT OF THE SPECIAL COMMITTEE

January 15, 1920

The Special Committee appointed December 18, 1919, to nominate and invite suitable persons to fill vacancies which will occur in the offices of the Society at the date of its annual meeting in January, 1920, respectfully report that they recommend the election of the following gentlemen to the offices designated:

		TERM TO EXPIRE IN
President.....	John Greenough.....	1921
Vice-President.....	Philip W. Henry.....	1923
Domestic Corresponding Secretary.....	W. Redmond Cross.....	1923
Treasurer.....	Henry Parish.....	1921
Councilors.....	<div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;"> Madison Grant Grenville Kane Allison V. Armour Alexander Hamilton Rice </div> </div> </div>	1923
	<div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;"> Paul Tuckerman Walter B. James James B. Ford </div> </div>	
	} Committee	

The reports of the Council and the Treasurer were approved and ordered on file. The persons recommended by the Special Committee for the offices to be filled received the unanimous vote of the Society and were declared duly elected.

NORTH AMERICA

Snow and the Railroads. The occasional heavy winter snows of the northeastern sections of the United States not infrequently cause temporary obstruction and delay of railroad transportation, with resulting inconvenience and often considerable pecuniary loss. Various methods of meeting these difficulties are adopted, such as snow fences, windbreaks formed of growing trees, etc. In many portions of the mountain area of the West, heavy winter snowfalls are the rule, and the railroad companies are forced to adopt elaborate and expensive methods to enable them to keep their trains running.

Andrew H. Palmer, of the U. S. Weather Bureau at San Francisco, Cal., has recently brought together some interesting illustrations of the effects of snow upon railway transportation (*Monthly Weather Rev.*, Oct., 1919, pp. 698-699). The chief difficulties are encountered in the region of the heavy snows of the Cascade Range and the Sierra Nevada. In the case of snows a few feet in depth on level ground locomotive push plows or rotary plows are employed. Where the snows accumulate to depths of 25 to 30 feet, or perhaps twice that depth in canyons, any such methods of removal are out of the question. Therefore the Southern Pacific Railroad (Overland Route) constructed its famous "thirty miles of snow sheds" over part of its tracks across the Sierra Nevada between Blue Canyon and Truckee. These cost \$42,000 a mile over single track and \$65,000 a mile over double track. In 1914, a typical year, \$65,000 were spent for repairs and \$91,000 for renewals. The average life of a snow shed is 22 years. These sheds are designed to sustain snow 16 feet deep. When the depths are greater, the snow must be shoveled off by hand.

There is naturally great danger of fire in the sheds. In summer four trains and in winter two trains are kept under constant steam for fire-fighting use. Further, all local engines carry pumps and are followed by tank cars filled with water to be used in case of fire. Concrete snow sheds have been built in some cases. On January 22, 1916, a snow slide near Corea, Wash., cut an all-steel passenger train in two, swept several coaches into a ravine, and caused the loss of several lives. Mr. Palmer's paper is illustrated by several views of the heavy snowfalls of the Sierra Nevada in relation to railroad operation.

R. DEC. WARD

A New Series of Rainfall Maps for the United States. An unusually important discussion of certain aspects of the rainfall of the United States is that by Joseph Burton Kincer, of the U. S. Weather Bureau, on "The Seasonal Distribution of Precipitation and Its Frequency and Intensity in the United States" (*Monthly Weather Rev.*, Sept., 1919, pp. 624-631, with 16 maps in 1:12,200,000). This article is accompanied by a new series of monthly and seasonal rainfall maps for the United States, which are now the "standard" maps, superseding all those previously published. The earlier monthly and seasonal rainfall maps were based on data from a limited number of stations, covering various years, not reduced to the same period, and had their isohyets drawn with little regard to topography. In Mr. Kincer's new maps the records have all been reduced to a uniform period of twenty years (1895 to 1914 inclusive). About 1,600 stations had actual averages for the period in question, with short breaks interpolated, and 2,000 other records were reduced to this uniform period. The isohyets were then drawn on hachured base maps with reasonable regard to topographic controls. In addition to these monthly and seasonal rainfall maps there are new maps showing the percentages of the annual amount of rain which occurs in the four seasons; the average annual numbers of days with precipitation of 0.01-0.25 inch, 0.26-1.00 inch, and over

2.00 inches; the average annual number of days with precipitation more than 1.00 inch in an hour; maximum precipitation in 24 hours; greatest number of consecutive days without 0.25 inch of rainfall from March 1 to September 30 (1895-1914); percentage of years with 30 consecutive days or more without 0.25 inch of rainfall in 24 hours from March 1 to September 30 (1895-1914). There are also graphs indicating for selected stations the variations, from year to year, in the annual, seasonal, and monthly totals.

Mr. Kincer distinguishes three major types of seasonal distribution of precipitation (see, in connection with this, R. DeC. Ward: *Rainfall Types of the United States*, *Geogr. Rev.*, Vol. 4, 1917, pp. 131-144). These are the Pacific type, which has a marked winter maximum; the Plains type, with relatively heavy rainfall in the late spring and early summer, and the Eastern type, with a comparatively uniform distribution through the year. These three are the most important types, "considering the areas covered and their climatic importance."

The new rainfall maps contained in Mr. Kincer's paper will also be included in the forthcoming rainfall section of the "Atlas of American Agriculture." A detailed note on these maps will be printed in the *Geographical Review* as soon as possible after the publication of that section.

R. DEC. WARD

AFRICA

Projected Railways Across the Sahara. The opening-up of vast undeveloped regions by railways is one of the most daring and successful operations of this generation, and the French have for many years dreamed of thus uniting their colonies in North Africa. Hitherto the most prominent names in this connection have been those of Bertolet and Souleyre. M. Bertolet suggested an extensive system comprising an Algiers-Cape trunk line and branches connecting Senegal, Lake Chad, and Nigeria. M. Souleyre's plan, on the other hand, confined itself to a trunk line across the Sahara, with branches linking it to Lake Chad and Nigeria.

A new contribution to Trans-Saharan schemes, by Lieutenant-Colonel Godefroy, has just appeared under the title "*Transsahariens et Transafricains*," (89 pp., with map, 1:8,000,000, Larose, Paris, 1919). This treatise brings a new light to bear upon the subject, for, while other plans have considered the Sahara as merely an unproductive waste, Colonel Godefroy considers that there are great possibilities of agricultural development in the desert itself, provided that the right route for crossing it be chosen. The route suggested would follow the historic caravan route which links up a line of oases, each the center of an extensive stretch of pasture land. The northern starting point would be the present terminus of the railway of which Colonel Godefroy is the director, the line which runs southward into the desert from Biskra to Tuggurt and northward towards Algiers. The projected line would run in a southwesterly direction through Wargla to Inifel and on to In Salah, there turning directly to the south and running to Buressa, whence it would join the Niger at Tosaye. The prospects of development in French Nigeria are painted as brightly as those of the Sahara, Colonel Godefroy asserting that, with the same system of controlling the floods as is used in Egypt, the region would become as fertile. If the Sahara should prove to be a second Argentina and Nigeria a second Egypt, the success of this part of the projected system should be assured.

The Trans-Saharan railway is, however, only a part of the whole scheme advanced by Colonel Godefroy. Two other trunk lines are also contemplated. One of these—an Algiers-Cairo line—is already more than half completed. Its purpose is to make use of the Cape-to-Cairo railway, as well as to provide for traffic along the southern littoral of the Mediterranean. The other trunk line would run along the western coast, connecting Dakar with Tangier. Since Dakar is only three days' voyage from Rio and Tangier is hoping to be connected with Europe by a tunnel, this would provide a short route to the New World. Again Colonel Godefroy is optimistic as to the possibility of agricultural development in the coastal region, which is less arid than the interior.

The plan is interesting, and, coming from the director of the Biskra-Tuggurt line, it commands attention. However, on reading the part about the possibility of development of the desert one feels constantly the tone of special pleading. For example the excessive insolation is reckoned as a valuable asset though no way has yet been found of utilizing the energy. In the same way the treatment of the chapter dealing with the difficulties of construction seems unduly optimistic. The question of labor, for example, is brushed lightly aside—the French army can provide that without difficulty.

Compared with former schemes, however, Colonel Godefroy's plan seems more practicable. There can be no question as to the advisability of the northern coast route nor of the future development of the upper Niger should a route be provided for its products.

E. M. SANDERS

ASIA

Two Interesting Maps of Syria. One of the most interesting "documents" at the peace conference at Paris was in the form of a woven rug presented by the women of the Moslem Trade School at Beirut. It was made in the form of a map, and showed the area claimed by Syrian nationalists for a united Syria. This recalls to mind a wonderful mosaic on the floor of a church at Madeba, Moab, on the plateau east of the Dead Sea. At our request Dr. Ellsworth Huntington has given us the following note on the subject (cf. also Palmer and Guthe: *Die Mosaikkarte von Madeba*, 10 colored plates, Leipzig, 1906, and Dr. Huntington's "Palestine and Its Transformation," Boston, 1911, pp. 204-207).

It is the oldest existing map of the region. Even today, though much of the map has been picked to pieces, one can still see palm trees by the warm Dead Sea and fish swimming in the Jordan River. Formerly the map extended from Damascus in the other direction. Fortunately the central parts around Jerusalem are still intact. As in many ancient maps the top is at the east.

For the geographer it would be hard to find anything more fascinating than this crude, yet rather effective ancient map. Perhaps some day the Syrians, with their art of putting maps on the floor, will not merely make one for the floor of some great church, but for the floor of some great schoolroom. A map on the floor seems strange to us, but to the Syrian it is perfectly natural, since he takes off his shoes and goes around in stocking feet. He sits on one side, and the map is spread out before him. For the children who sat in the old church at Madeba it must have been an interesting sight when they had tired of the service to see the lions chasing the gorillas among the palm trees of Palestine on the floor before them.

Wasteful Exploitation of Manchurian Forests. No country has suffered more heavily than China as a result of reckless destruction of her forests, yet deforestation continues in the Manchurian provinces. Much of Manchuria, lying as it does in the great wheat belt of the world, is, of course, land properly devoted to agriculture. With the building of the Chinese Eastern Railway clearing and cultivation have gone on apace. Harbin, little more than twenty years ago a hamlet of fishermen, is now a town of 100,000 and a great wheat mart. The western section of the province of Kirin and the valleys of the large rivers are under cultivation, and settlers are pushing forward. Yet vast areas in Kirin province and also north of the Sungari are natural forest reserves, and it is against the wasteful exploitation of these areas that a protest has been recently put forward by Captain Arthur de C. Sowerby, who has made several journeys of exploration in these little-known sections of Manchuria (*The Exploration of Manchuria*, *Geogr. Journ.*, August, 1919).

The great Kirin forest covers the Chang Pei range and extends northwards, touching the banks of the Sungari east of Harbin and stretching well into the angle formed by the junction of the Ussuri and the Amur. The area of the forest is said to be equal to that of Scotland. The splendid forests of the Chang Pei Shan, chiefly deciduous, with the oak as the predominant tree, are being cut on the southern side by Japanese, who get the timber out by way of the Yalu, and on the northern side by Chinese, who make use of the Sungari and its tributaries. Still farther north Russian and Chinese companies extract timber consisting chiefly of pine. Enormous quantities of oak, walnut, and maple are cut for fuel for the populace and for locomotives and steamers on the Sungari. From his camp on the Sungari Captain Sowerby had opportunity of gaging the extensive output of timber from the slopes at the sources of the main stream and its tributaries. "Every hour of the day dozens of huge rafts of logs came floating past. Some of these contained twenty or thirty thousand feet of timber, averaging 3 to 4 feet in diameter, sometimes much more."

GEOGRAPHICAL NEWS

OBITUARY

FRANCISCO P. MORENO, the foremost Argentine geographer, died at Buenos Aires on November 22, at the age of 67. In the words of Bailey Willis' excellent biography of Moreno in the "Geographen-Kalender" (Perthes, Gotha) for 1911, to which the reader is referred for fuller information, "among the chief results of his career . . . there stand out conspicuously the exploration of Patagonia, the organization of the Museo de La Plata and of the researches conducted under its auspices, the conclusion of the Argentino-Chilean boundary arbitration according to a satisfactory division of the territory in dispute, and the institution of topographical surveys of the Province of Buenos Aires." In 1909 Señor Moreno was awarded the Cullum Geographical Medal of the American Geographical Society.

GEOGRAPHICAL REVIEWS

Beginning with this number the minor bibliographical entries will be omitted from the department heretofore known as "Geographical Publications", and only reviews will be published under the correspondingly changed heading of "Geographical Reviews." The omitted entries, with references to the reviews here published, will be gathered together and issued as an annual volume which will record the geographical publications that have come to the Society's notice during the year. This annual bibliography will be sent free to all institutions or individuals exchanging publications with the Society or subscribing to the Review and, on request, to Fellows who may desire it. The first issue, it is expected, will appear early in 1921.

OUR IMMIGRATION PROBLEM

J. W. JENKS AND W. J. LAUCK. **The Immigration Problem: A Study of American Immigration Conditions and Needs.** 4th edit., revised and enlarged. xxv and 605 pp.; map, diagrs., bibliogr., index. Funk & Wagnalls Co., New York and London, 1917. \$1.75. 8 x 5½ inches.

The value of this book is attested by its appearing in a fourth edition. It stands alone in the field of immigration literature, being the only comprehensive and authoritative presentation of the findings of the United States Immigration Commission in condensed and accessible form.

The Immigration Commission came into being through a peculiar freak of legislation. During the summer of 1906 the House was debating an immigration bill which contained as one of its major features a provision for the imposition of a reading test on would-be immigrants. This proposed measure had been before Congress pretty continuously for fifteen years or so, and, while for most of that period the preponderance of sentiment in both houses had been decidedly in its favor, yet through the various exigencies of Federal legislation it had never become law. At the date mentioned there was no question that ample majorities of Senate and House were in favor of the literacy test. Speaker Cannon, however, was vehemently opposed to it and by tactics more vigorous than parliamentary placed obstacle after obstacle in its way. Finally, on June 25, Mr. Grosvenor of Ohio proposed an amendment which struck out the entire section providing for a literacy test and in its place substituted a section creating an Immigration Commission. In this form the bill passed, and early the following year the Commission was appointed by President Roosevelt.

This piece of political legerdemain was by no means unfortunate. In the first place, the Immigration Commission proved to be one of the most scholarly and useful commissions Congress had ever created. In the second place, with delightful irony, one of its major recommendations was that a literacy test be imposed, and it was largely upon this recommendation that the test became law ten years later.

The Immigration Commission was composed of three Senators, three Representatives, and three civilians, and its total working staff considerably exceeded one hundred. It spent nearly three years in its investigation, when its career was abruptly terminated by the refusal of Congress to make any further appropriations for it. Here again the result was not unfortunate. A very thorough and sweeping research had been made, covering not only this country but the European sources of immigration; but the material had not been thoroughly digested by the Commission, nor had conclusions been worked out in detail and completeness. As a consequence the published report consists almost entirely of facts and figures, with very little space devoted to the statement of the Commission's own conclusions and recommendations. Students of the subject, therefore, are forced to go to the original data in support of their arguments, which is much better than quoting the opinions of an official body, however trustworthy.

The report of the Commission comprises forty volumes. It was very difficult to secure the work at the time of its publication, and it is practically unobtainable now. Only the best equipped even of our large libraries possess it. It is accordingly very important that a trustworthy digest should be available. Professor Jenks and Mr. Lauck are particularly well fitted to supply such a need, the former having been a member of the Commission and the latter one of its important experts. The authors describe themselves as "not advocates, but interpreters of facts." It need hardly be added that in their discussions they have not confined themselves absolutely to the data contained in the report of the Commission.

In the present edition the discussions have been brought up to date, particularly by the inclusion of a chapter on the immigration law of 1917 prepared by Mr. W. W. Husband, the full text of this bill, a presentation of the plan proposed by Dr. Sidney L. Gulick, a brief bibliography, and numerous additional diagrams and figures.

HENRY P. FAIRCHILD

J. F. STEINER. The Japanese Invasion: A Study in the Psychology of Inter-Racial Contacts. With an introduction by R. E. Park. xvii and 231 pp.; bibliogr., index. A. C. McClurg & Co., Chicago, 1917. \$1.25. 7½ x 5 inches.

This little volume may be heartily commended to those who desire to understand the problem of Japanese immigration into the United States. The importance of that problem does not appear to be realized in some parts of our country; its complicated character is still less appreciated.

Dr. Steiner was for some years a resident of Japan, as a teacher in a mission college at Sendai, and was able to study the economic and social conditions there at first hand. Japanese sentiment therefore is treated sympathetically and fairly, and this gives added weight to the conclusion at which the author arrives.

There are four angles from which the problem must be approached—the economic, the racial, the social, and the political. There is a tendency in the United States to treat it as though it were essentially, if not wholly, an economic one. The economic phase is indeed a very important one. Overpopulated Japan with low wages and low standards of living for her laborers thrusts a portion of them out to seek for new homes in other lands where better conditions prevail. The most attractive conditions are found in Australia, South America, Canada, and the United States; but upon reaching these countries the Japanese meet with the opposition of the labor unions. This opposition, which is based upon economic grounds, is strongly re-enforced, as Dr. Steiner points out, by the racial prejudice which springs up quite naturally when such dissimilar types as the Japanese and the white man are brought into contact. The author calls attention, too, to a fact often overlooked, that this prejudice exists in the Japanese as well as in the American.

Dr. Steiner reminds us that “during the negotiations at Washington in 1913 between Viscount Chinda and the Federal Government concerning the California alien land law, the Japanese ambassador was given repeated assurances by both the President and the Secretary of State that the enactment was based on purely economic considerations and was not the outcome of racial prejudice.” Dr. Steiner does not believe that such declarations convince anybody, least of all the Japanese, that race prejudice “has played such an insignificant part in the American-Japanese problem.” In another paragraph he says: “Nothing is gained by ignoring the racial aspects of the question as is now the tendency in some quarters.” In this statement we believe he is quite correct.

Among the more intelligent classes in both countries, it is true, there is but little of race prejudice. Many persons seem to be entirely free from it. Both governments have striven consistently to maintain the traditional friendship; the merchants, too, of both countries seek to remove this prejudice. It is, however, an unreasoning sentiment that springs too naturally to be easily eradicated from the mind of the ordinary man.

Dr. Steiner quotes from two well-known friends of the Japanese to show how real this prejudice is on the part of the Japanese. From Professor Ladd is the following: “Among the people of all classes, uninformed, unreasoning feeling towards all foreigners still underlies the crust of enforced or selfish and conventional politeness.” From Dr. Gulick is this: “Few foreigners have received a hearty welcome from the people at large. They are suspected and hated; as little room as possible is made for them. The less of their presence and advice the better.”

Professor Ladd's statement was written in 1895, that of Dr. Gulick in 1905. Dr. Steiner says: “That these statements are even today not wide of the mark can be verified by anyone who has an intimate knowledge of the life of the Japanese people.”

This prejudice on the part of both peoples is shown clearly in their attitude towards inter-racial marriage, decidedly frowned upon by both. The American wife of a Japanese husband and the Japanese wife of an American husband both suffer from social ostracism. The few exceptions serve to emphasize the rule, and the unfortunate Eurasian child is disliked in Japan both by Japanese and by Europeans.

Thus social problems also arise out of the immigration problem. But that of inter-racial marriage is not the only one. Neither is it the principal one. When the Japanese immigrant meets with a chilly reception in the United States, he is driven by this prejudice to limit his social intercourse as far as possible to his fellow countrymen. Thus in California the Japanese farmers, gardeners, and laborers tend to segregate themselves and form separate communities. This is inimical to the social healthfulness of the state. These immigrants thus living apart make little or no progress in knowledge of the language, customs, and ideals of their American neighbors. They establish schools

where instruction is given in the Japanese language, and loyalty is inculcated not to the state in which they reside but to the mikado over the sea. The nineteen Buddhist temples which they support in California still further strengthen the ties with the homeland and widen the breach between them and the people among whom they dwell.

From this condition of affairs there arises a political problem with which Dr. Steiner does not deal. The American-born children of Japanese parents are, according to American law, citizens of the United States; but in Japanese law they are subjects of the mikado and as loyal subjects must go home for military instruction, which many of them do when they arrive at the proper age. Growing up in such an environment as has just been described and trained to love supremely and to defend the island empire in the Orient, how can it be expected that they will make good citizens of the United States? Under a more hospitable reception the results would no doubt be quite different. It must be remembered, however, that the masses of the Japanese immigrants in California are not of the cultured classes but come from the rural districts, where ignorance and conservatism prevail.

What is the solution of the problem thus outlined? Dr. Steiner reviews the measures taken by the governments and proposed by others but does not find them satisfactory. It is not so clearly understood as it should be that there is no convention absolutely excluding Japanese laborers from the United States. The "gentleman's agreement" is an informal arrangement, in which Japan undertakes not to issue to laborers, with certain exceptions, passports for the United States.

Among those who have already come in large numbers into this country are farmers and gardeners. That they are skillful, industrious, and law-abiding none can deny, but this does not make them welcome to those who must compete with them and who are unwilling to toil as unceasingly as the Japanese laborer, deprive themselves as he does of recreation, or adopt his standard of comfort.

Of Dr. Gulick's proposal that a general immigration law be enacted limiting the incoming of immigrants from any country to a certain per cent, say 5 per cent, of the number of native-born of the first generation, together with the number of naturalized citizens of that race in the United States at the time of the national census next preceding, Dr. Steiner says: "While such a law theoretically seems adapted to meet the present situation, it is such a radical departure from our traditional policy concerning European immigration that it is doubtful if in the near future it would receive the support of the American public." Dr. Steiner does not think that it would please the Japanese either, "who, to all practical intents and purposes, even if not theoretically, would be discriminated against."

In Dr. Steiner's opinion the first step to be taken towards a solution of the problem is to recognize frankly the racial factors involved. The next is to induce the Japanese to "see the wisdom of permitting only the best representatives of their race to come to America." This will enable the peoples of the two countries to meet under circumstances "the most favorable for a mutual appreciation of each other's character." Mutual patience and forbearance are necessary, and the problem "must be worked out by a gradual process which it may take generations to complete."

"Nothing," the author says, "is more fraught with peril than the continuance of our present half-hearted and irresolute policy toward the Far East."

E. T. WILLIAMS

PHYSICAL GEOGRAPHY OF NORTHWESTERN AMAZON BASIN

P. P. BAUER. *NW-Amazonien: Ein Beitrag zur Geographie Äquatorial-Amerikas.* xiv and 107 pp.; map, diagrs., ill., bibliogr. Rudolf M. Rohrer, Brunn, 1919. 9 x 6 inches.

Dr. Bauer, Moravian by birth, was a member of Dr. Hamilton Rice's expedition of 1912-13 to the region between the branches of the Amazon and the Orinoco and gave special attention to geology and topography. His present report opens with a bibliography of the region, which is followed by a 20-page review of previous explorations and a 10-page summary of relations to the rest of South America. Then come 30 pages on structure and form of northwestern Amazonia, 14 on its hydrography, and 25 on its climate. The region thus treated lies chiefly between the equator and latitude 4° N., or between the Yapura branch of the Amazon and the Guaviare branch of the Orinoco; it stretches about 350 miles eastward from the folded and deeply dissected ranges of the Andes to the tableland of Guiana, which is formed of from 600 to 1,500 meters of horizontal sandstones lying on a relatively even foundation of crystalline rocks.

The piedmont belt in the west, occupied by heavy deposits of coarse detritus actively outwashed from the mountains, is followed by gently east-sloping upland plains, known as the Mesas of Pardaos and of Iguaje, seldom over 500 meters in altitude, composed of heavy pervious sandstones mostly without tree growth in spite of abundant rainfall.

Here the main Andean river courses, narrowed and broken by rapids and bordered by belts of forest, are incised beneath the uplands, which break off 70 or 80 miles from the Andes in a bold escarpment, irregularly lobate in plan, fronted by isolated sandstone outliers and dwindling hills of the underlying impervious beds, all heavily tree-covered. Thus descent is made to a forested plain in which the main rivers, as well as many others which are fed by copious springs that issue from the impervious beds at the base of the sandstone escarpment, wander freely eastward in split or meandering channels without rapids. The plain is, however, followed by a second upland, the Mesa of Yambi, which is described as composed of the same heavy pervious sandstones as those of the Mesa of Pardaos and as presenting an escarpment to the west as well as to the east. It is only after passing the second mesa, in which the rivers are again broken by rapids, that at a distance of 140 miles from the Andes the vast east-stretching area of crystalline rocks is entered upon; for the first 60 miles it is a peneplain of gneiss at an altitude of about 200 meters, but farther on it is much interrupted by granitic monadnocks, often bare, rising from 100 to 900 meters, as Wallace long ago reported. It is in this region, which extends for 150 miles or more to the sandstone tableland of Guiana, that the Cassiquiare connects the Orinoco with the Negro-Amazon. Bauer ascribes the bifurcation to a capture of Orinoco waters by a tributary of the Negro, because he finds the fall of the latter to be steeper than that of the former; but, until the topographic details of a very recently formed elbow of capture are found, the case can hardly be considered proved.

The several chapters of which the foregoing physiographic summary is an abstract, are less easily understood than could be wished; partly because the simple forms of the region are treated with unnecessary, even laborious elaboration, partly because the generalizations as to topography are complicated by discussions of the misunderstandings of earlier explorers, and still more because the text is not sufficiently illuminated with diagrams. It is especially for the latter reason that the relation of the Mesa of Yambi to the Mesa of Pardaos is not clear. A greater importance is attached to the warm and wet climate in the sculpturing of the region than seems warranted, for very similar landforms are found in other regions of similar structure but different climate.

W. M. DAVIS

A SCIENTIFIC GUIDEBOOK

W. M. DAVIS. *A Handbook of Northern France*. xi and 174 pp.; maps, diagrs., index. Harvard University Press, Cambridge, Mass., 1918. \$1.00. 6½ x 4½ inches.

The unusual success of this little book, which was used by thousands of officers in France, is truly merited. It supplies material (which can be found in no other English book) on those broad features of the geography of northern France that every person interested in the larger operations and relations of the war finds indispensable. Professor Davis has selected the outstanding features of geology, topography, drainage, coal basins, railroads, etc., and has placed them upon original sketches, block diagrams, etc., in such a way as to give a vivid picture and explanation of the country. It is not a book useful merely in time of war; it is an admirable guidebook for the thoughtful traveler. The graphic quality of Professor Davis' drawings was never put to a more useful purpose. The small pocket size enables one to carry it conveniently.

FRENCH DEVELOPMENT OF MOROCCO

COMTE DE LA REVELIÈRE. *Les énergies françaises au Maroc: Études économiques et sociales*. 2nd edit. xiv and 561 pp.; maps, ill., index. Plon-Nourrit & Cie., Paris, 1917. 12 frs. 50. 10 x 6½ inches.

The book shows what Morocco, now a protectorate of France, bids fair to become under the policy that France has been pursuing since 1911. Morocco includes two great areas that are very dissimilar. The regions seaward of the Atlas Mountains have an adequate amount of rain, and winds from the Atlantic cool the air so that the climate is temperate and healthful and productive of abundant verdure. These regions have the further advantage of good soil, so that a vast area is well adapted both for grazing and cultivation.

On the other hand, the regions inland from the Atlas are nearly rainless—a brown and arid expanse, torrid in temperature a part of the year and blistered by hot winds from the Sahara. The French, naturally, are confining their attention to the more promising part of the country (see map in *Geogr. Rev.*, Vol. 8, p. 57).

The result is that knowledge of the land has been largely advanced, and most of the people, finding that the foreign régime is protecting their lives and property, are cheerfully accepting it. Ten years ago two-thirds of the population were unfriendly to all whites. Travelers, as a rule, had to take circuitous routes to reach their destination. The telegraph and telephone were not known except in a few coast towns. Morocco was

one of the least known and darkest parts of Africa though nearer to Europe than any other African land. All this is being changed under French rule. Wireless telegraphy connects all parts of the country, and over 8,000 miles of telegraph wire has been strung. Agricultural, horticultural, arboricultural, veterinary, and meteorological services have been established, and agricultural fairs are held. Some railroads also are building.

The French have, thus far, extended their influence chiefly in the Atlantic and Mediterranean ports and their wide hinterland, covering about half of the best part of the country.

At the head of the whole project stands General Lyautey, Resident General, a man of great tact and resource, under whose direction all phases of the work have gone steadily forward.

The book contains a store of information on topics relating to the protectorate, the excellent relations between the French and the natives, property and the methods of transferring it, principal towns and ports, river navigation, highways, agriculture, forests, industries, commerce, and finances. All the information on physical features and climate is to be found in the chapter headed "Agriculture." These natural factors, on which development so largely depends, are scantily treated; but the outlines of topography and weather and their effects upon the people and their enterprises are briefly noted.

The population of the entire French zone is estimated at 5,400,000. Most of Morocco is under French control; but Tangier, the leading port, is under international management, and a comparatively small area, partly in the north (the Rif) and partly in the extreme south (Rio de Oro), is governed by Spain.

France is improving Moroccan methods of tillage. The book shows that good plowing is beginning to supplant skin-deep cultivation. The scythe and harvesting machinery are coming in. Intensive cultivation will be the rule. The government intends to give the poorer people a chance to acquire small holdings so that they may support their families on their own plots of ground. Forestry methods will be introduced to provide future wood crops; and all the domestic animal industries will be encouraged, for they have large possibilities. Morocco is thus making progress in many ways.

For an article on the same topic as this book see A. de Tarde: *The Work of France in Morocco*, in the *Review*, Vol. 8, 1919, pp. 1-30.

CYRUS C. ADAMS

THE FUTURE OF INDIA

WILLIAM ARCHER. *India and the Future*. 326 pp.; ill., index. Alfred A. Knopf, New York, 1918. \$3.00. 9½ x 6 inches.

Mr. Archer has given to the public a new outlook of the Indian people and their progress. The entire theme of the story is based on the faith that a rational movement towards nationalism exists and that a stable world order is attainable. India is taken as a test case. If the people living south of the Himalayas can be emancipated from superstition and can take their place among the nations of the earth, then, the author believes, the problems of race and nationality which are being thrust upon the world today are capable of a solution which will be just and final. If, on the other hand, a weak nation (India) is always to be encroached upon by a strong nation (England) then any attempt to seek a solution to international problems is almost futile. In trying out the test case many sides of the Indian people are considered: its capabilities for being a united nation; its possibilities of rising above its religion; the success of any social reform movement to free the land from caste and its subsidiary evils; the use of the present Indian opposition to foreign rule; and the tendency of India's art, culture, and religion. In the discussion a splendid balance is attained. Praise and appreciation are mingled with just censure. The real achievements of India excite the author's ardent admiration, but the "multitudinous nightmares of its indigenous cults" are displayed in all their rawness. In the final analysis, however, Mr. Archer is looking forward to the end of British rule in India, the beginning of which was "the most heroic adventure in history." He takes the stand that English rule is a means, not an end; that it is not good in itself but is infinitely better than things as they were; and that, while the time has not yet come when this overlordship can be terminated, the face of the Indian service should be turned definitely towards educating the Hindu to assume the responsibilities of national life.

ROBERT M. BROWN

THE WORLD'S FOOD SUPPLY

V. C. FINCH AND O. E. BAKER. *Geography of the World's Agriculture*. 149 pp.; maps, diagrs., bibliogr., indexes. Office of Farm Management, U. S. Dept. of Agriculture, Washington, D. C., 1917. 10½ x 13 inches.

In the words of the authors, "the purpose of this study is to show the geographic origin of the world's supply of food and of other important agricultural products and

to indicate briefly the climatic, soil, and economic conditions that account for the distribution of the crops and live stock of the world." The authors' efforts have culminated in an atlas of great merit. Although as an atlas showing production it is not original in its conception, yet it stands out as a distinctive contribution for both the professional geographer and the practical layman.

The maps with the exception of the first two, which are in colors, are all printed in black and white. The colored maps show land relief and precipitation, respectively, for the entire earth (Mercator projection). The former is based upon "Physical Maps of the Continents" by J. Paul Goode (Chicago, 1913-15) and the latter upon "Oxford Wall Maps of the Continent" by A. J. Herbertson (1908-11) "except the United States, which is based on data supplied by U. S. Weather Bureau." In the compilation of the black-and-white maps the authors have had the valuable assistance of many government specialists. Mr. Finch prepared the part relating to foreign countries while Mr. Baker prepared the sections relating to the United States.

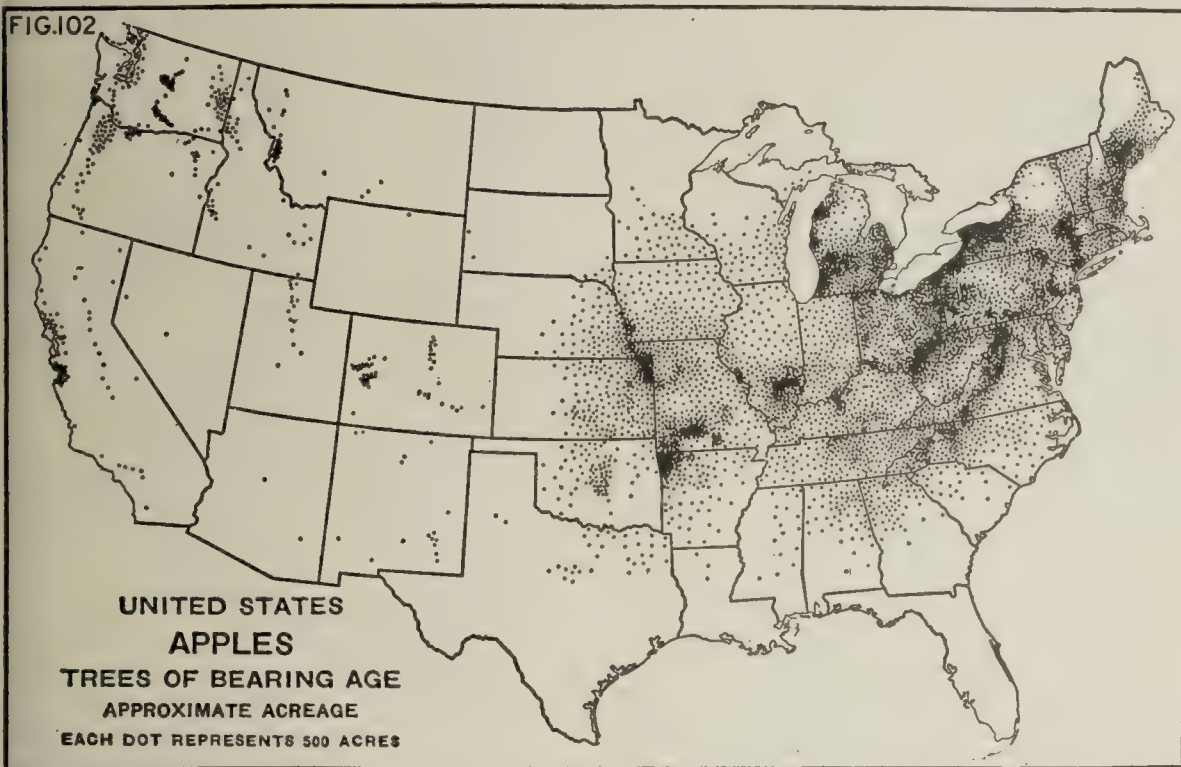


FIG. 1—Reproduction of a figure from Finch and Baker's "Geography of the World's Agriculture" to illustrate the dot method of distribution representation employed in that work.

The base maps are all in outline. On the Mercator maps are shown country boundaries, the states of the United States, and the provinces of Canada—all without names. In the case of individual countries, counties or their equivalent are drawn where the map is sufficiently large (nearly a full page) to allow of such detail. An identification map of the world gives the names of all countries and in the case of the United States and Canada the names of states and provinces respectively. Similar identification maps for the United States, Europe, Canada, India, and Argentina are given separately and on a larger scale. By reference to these maps the names of political divisions can easily be determined on the production maps.

The dot method is employed for showing distribution. By letting one dot represent a unit quantity and distributing the dots with reference to place of production, the authors have succeeded in presenting a kind of shade effect which portrays at once the relative intensity of production. Figure 102 on page 80, showing "Trees of Bearing Age" for apples, is reproduced here to illustrate the effectiveness of this cartographic scheme. This method serves further to displace generalizations and to give accuracy.

In each instance distribution is shown by areal values, excepting rice, cotton, tobacco, sugar, and coffee, for which dots represent actual production. Accompanying the areal maps are graphs of total production, so that, by combining the area represented by dots with the total production shown by the graph, one can ascertain very closely the density of production.

These maps help one visualize, as no other method can, the distribution and produc-

tion of the earth's vital agricultural products. It is unfortunate, however, that the authors should have failed to show parallels and meridians. That their significance is recognized is attested by the wheat map for Europe (p. 21), where the 50th parallel is indicated as the northern limit of wheat, and the sugar map of the world (p. 73), where the dividing line between the growing areas of beet and cane sugar is drawn. An indication of the latitude and longitude on the margins of the maps would have avoided marring their legibility and yet would have afforded some clue as to location and latitudinal climatic effects.

The treatment as a whole is by products rather than by countries. Among the points developed in most of the discussions are the place of origin of the product, the conditions under which it prospers with reference both to nature's controls and the influence of markets, and its practical value, including its relation to population. Statistical tables accompany the descriptive matter occasionally, and also special small maps to illustrate some phase of the subject deserving emphasis. Inset maps or diagrams as parts of the larger maps further illuminate the atlas.

EUGENE VAN CLEEF

ARISTOTLE'S TREATISE ON METEOROLOGY

— **Aristotelis meteorologicorum libri quattuor.** Recensuit, indicem verborum addidit F. H. Fobes. xlviii and 236 pp.; index. Harvard University, Cambridge, Mass., 1919. 9 x 6 inches.

Aristotle's treatise on meteorology is one of the great milestones in the development of the science of the earth's atmosphere. It remained for nearly two thousand years the standard text, and all the textbooks which were issued in Europe till the end of the seventeenth century were based exclusively upon it. Viewed in the light of the modern developments of meteorology, Aristotle's treatise is today inevitably very antiquated; but the important part it played throughout many centuries, as a guide, an inspiration, and a systematic presentation of important facts, entitles it, even now, to more than passing mention. In his epoch-making "Lehrbuch der Meteorologie," Schmid well said of Aristotle, "unverkennbar hat bereits der grosse Gelehrte des Alterthums, hat Aristoteles tiefgehend einige wichtige Momente, die jetzt erst zu ihrer Geltung gekommen sind, ergriffen; allein seine Schüler, Commentatoren und Nachfolger, unter den Griechen Theophrast, unter den Römern Plinius und Seneca, haben diese Anfänge nicht wesentlich entwickelt und erweitert" (p. 3).

Aristotle's work has been translated into French, English, and Italian, the only fairly recent translation being that in French (1863). A new English translation was promised by the Clarendon Press before the war.

Professor Fobes's new text of the four books of Aristotle's "Meteorology" is a scholarly piece of work, obviously first of all of very distinct importance to students of the classics, but of more than passing interest to students of meteorology. The Greek text of the four books of the "Meteorology," with the footnotes, occupies about 160 pages; somewhat over 100 pages are devoted to the preface, bibliographies, and index—all of which are in Latin. The publication of this volume inevitably leads to the expression of the hope that a new English translation of Aristotle's classic may not long be delayed.

R. DEC. WARD

Note

With regard to the sentence "In quality of execution the maps are scarcely creditable to the India Survey," in the brief comment on Sheets 78 G, H, and J, of the topographic map of India, in the April, 1919, *Review* (Vol. 7, p. 280), Lieut.-Col. H. H. Turner, R. E., Superintendent, Map Publication, Survey of India, points out that the maps criticized are provisional issues only, and that they are reproductions by photography of old atlas sheets, pasted together to cover the area of a modern ¼-inch sheet (i. e. on the scale of 1:253,440). These provisional sheets will in time all be replaced by ¼-inch sheets prepared by modern surveys.

THE GEOGRAPHICAL REVIEW

CONTENTS FOR FEBRUARY, 1920

Desert Syria, the Land of a Lost Civilization. By Howard Crosby Butler. (1 insert map, 2 text maps, 28 photos) . 77

Antillia and the Antilles. By William H. Babcock. (5 maps) 109

Arctic Geography and Eskimo Culture : A Review of Steensby's Work. By Clark Wissler. (2 maps) 125

The St. Louis Meeting of the Association of American Geographers. By R. H. Whitbeck 139

Geographical Record 141

<i>American Geographical Society</i>	<i>Polar Regions</i>
Meetings of February 141	An Eskimo Migration and Its Forerunner 142
<i>North America</i>	
Does Cultivation Increase Rainfall? 141	
Thunderstorms at Panama . . 141	<i>Geographical News</i>
<i>Europe</i>	Organization of the American Meteorological Society . . 144
A Relief Model of Wales . . 141	

Geographical Reviews 145

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OUR CONTRIBUTORS

Professor Howard Crosby Butler has traveled extensively in Greece, Northern Africa, and Nearer Asia. In 1899-1900 he organized and conducted the American Archaeological Expedition to Syria and is the author of "Architecture and Other Arts", Part II of that expedition's publications. He organized and conducted the Princeton University Archaeological Expeditions to Syria in 1904, 1905, and 1909, and is the author of Division II of their publications, entitled "Architecture in Syria". From February, 1910, until July, 1914, Professor Butler was director of the American excavations at Sardis in Asia Minor (see preliminary reports in *American Journ. of Archaeology* for 1910-1914). He has been professor of the history of architecture in Princeton University since 1906 and is now director of the School of Architecture in Princeton.

Mr. Babcock is a lawyer and author of Washington, D. C., who has devoted himself to the history of early cartography and geography. He is the author of "Early Norse Visits to North America" (*Smithsonian Misc. Colls.*, Vol. 59, No. 19, 1913); "The So-Called Mythical Islands of the Atlantic in Medieval Maps" (*Scottish Geogr. Mag.*, Vol. 31 and 32, 1915 and 1916); "Atlantis, or Antillia" (*Geogr. Rev.*, Vol. 3, 1917); "Markland, Otherwise Newfoundland" (*ibid.*, Vol. 4, 1917); "Corvo, Our Nearest European Neighbor" (*ibid.*, Vol. 5, 1918); "The Island of the Seven Cities" (*ibid.*, Feb., 1919); "St. Brendan's Explorations and Islands" (*ibid.*, July, 1919).

Dr. Wissler is curator of anthropology at the American Museum of Natural History. His special field of investigation is the American Indian studied from the environmental point of view. Among his publications are: "Aboriginal Maize Culture as a Typical Culture-Complex" (*Amer. Journ. of Sociology*, 1916); "The Influence of the Horse in the Development of Plains Culture" (*Amer. Anthropologist*, 1914); "North American Indians of the Plains" (1912); "Material Cultures of the North American Indians" (1915). He has recently gathered together his studies in an admirable handbook "The American Indian: An Introduction to the Anthropology of the New World" (1917), the geographical quality of which will shortly be commented on in these pages.

Mr. Whitbeck is professor of geography and physiography at the University of Wisconsin. He was for eight years editor of the *Journal of Geography*. Professor Whitbeck is the author of "A Geography of New Jersey" (State Supplement to Tarr and McMurry's New Geographies, 1906); "The Geography and Industries of Wisconsin" (*Wisconsin Geol. Survey Bull.* 26, 1913); "The Geography of the Fox-Winnebago Valley" (*idem. Bull.* 42, 1915).

THE GEOGRAPHICAL REVIEW

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No. 2

DESERT SYRIA, THE LAND OF A LOST CIVILIZATION

By HOWARD CROSBY BUTLER

Princeton University

[With separate map, Pl. I, facing p. 108.]

Among the regions which were once populous and highly civilized, but which are now desert and deserted, there are few which were more closely connected with the beginnings of our own civilization than the desert parts of Syria and northern Arabia. It is only of recent years that the vast extent and great importance of this lost civilization has been fully recognized and that attempts have been made to reduce the extent of the unexplored area and to discover how much of the territory which has long been known as desert was formerly habitable and inhabited. The results of the explorations of the last twenty years have been most astonishing in this regard. It has been found that practically all of the wide area lying between the coast range of the eastern Mediterranean and the Euphrates, appearing upon the maps as the Syrian Desert, an area embracing somewhat more than 20,000 square miles, was more thickly populated than any area of similar dimensions in England or in the United States is today if one excludes the immediate vicinity of the large modern cities. It has also been discovered that an enormous desert tract lying to the east of Palestine, stretching eastward and southward into the country which we know as Arabia, was also a densely populated country. How far these settled regions extended in antiquity is still unknown, but the most distant explorations in these directions have failed to reach the end of ruins and other signs of former occupation.

Various questions arise in our minds if we pause to think of this strange condition of things. When did the fertility of these lands cease and their civilization come to an end? How long had that civilization flourished? What caused its undoing? Some of these questions are well-nigh unanswerable, others may be answered with more or less definiteness, but each ques-



tion involves a number of minor problems impossible of solution. In the present article, I shall not attempt to answer the above questions in the order given or to offer solutions to the many problems involved, but shall endeavor to give a description of the country as it is today and to draw inferences as to its condition in ancient times. In the process certain questions will be answered, and various solutions of the problems will suggest themselves; other problems will be left to the reader's speculative imagination.

THE HISTORICAL BACKGROUND

A few definitely determined facts will undoubtedly help to give an historical background to the descriptions. It is plain from the architectural remains, and from inscriptions, that these regions have not been lived in to any wide extent since the early years of the seventh century after Christ. The date 610 seems to mark the end of civilized occupation for a large part of the country; and this date coincides interestingly with the last great Persian invasion in 610-612 and the wars of conquest under the generals of the Prophet Mohammed which began less than twenty years later.

The earliest definite records found in the country itself indicate that civilization had reached a high point of development here at the beginning of the Christian era, and there is less definite evidence to be gleaned from the monuments and from the reading of history to show that this civilization had begun at least two or three hundred years earlier; but there are also remains well scattered over the region which suggest the existence of a far older civilization about which we know little, and the history of the country, gathered in fragments from the Holy Scriptures and from the written records of the ancient Egyptians and Assyrians, plainly indicates that the region was occupied by a civilized and organized society in the earliest days of man's civilized state.

The inhabitants of the entire region were of comparatively pure Semitic stock until the conquests of Alexander and his successors, in the fourth century before Christ, introduced an element of European blood through colonization. During the historical period represented by the remains still visible in the country the northern half of the region was ruled by the Greek kings, that is the Diadochi, successors of Alexander's general Seleukos, with their capital at Antioch, from the fourth to the first century before Christ. During most of this period the southern half was divided into independent, or semi-independent, kingdoms of Oriental origin, the Maccabean kingdom of the Jews, the Idumean kingdom, and the early Arabic Nabataean kingdom of the extreme south. Between the middle of the first century before Christ and the early years of the second century after Christ the country passed by slow degrees into the Roman Empire as the provinces of Syria, Arabia, Palestine, etc. With the rise of Chris-

tianity to a state religion in the fourth century the whole country passed under the control of the Eastern Empire and remained a powerful bulwark of Christian civilization until it was cut off in the early years of the seventh century. Two Aramaic dialects constituted the speech of the inhabitants, Syriac in the north and Nabataean, an early form of Arabic, in the south; but, after the conquest of Alexander, Greek was introduced and in time became the chief written, and probably the common spoken, language of the whole country during the succeeding centuries under Rome and Constantinople.

Northern Syria

RUINS IN THE LIMESTONE HILLS EAST OF THE ORONTES

The traveler who has crossed the settled, and more or less populous, coast range of Northern Syria and descended into the narrow fertile valley of the Orontes, encounters in any farther journey toward the east an irregular range of limestone hills lying north and south and stretching to the northeast almost halfway to the Euphrates (cf. map, Pl. I). These hills are about 2,500 feet high, rising in occasional peaks from 3,000 to 3,500 feet above sea level. They are gray and unrelieved by any visible vegetation. On ascending into the hills the traveler is astonished to find at every turn remnants of the work of men's hands, paved roads, walls which divided fields, terrace walls of massive structure. Presently he comes upon a small deserted and partly ruined town composed of buildings large and small constructed of beautifully wrought blocks of limestone (Fig. 2), all rising out of the barren rock which forms the ribs of the hills. If he mounts an eminence in the vicinity, he will be still further astonished to behold similar ruins lying in all directions. He may count ten or fifteen or twenty, according to the commanding position of his lookout. From a distance it is often difficult to believe that these are not inhabited places (Fig. 1); but closer inspection reveals that the gentle hand of time or the rude touch of earthquake has been laid upon every building. Some of the towns are better preserved than others; some buildings are quite perfect but for their wooden roofs which time has removed, others stand in picturesque ruins, while others still are level with the ground (Fig. 3). On a far-off hilltop stands the ruin of a pagan temple, and crowning some lofty ridge lie the ruins of a great Christian monastery (Fig. 4). Mile after mile of this barren gray country may be traversed without encountering a single human being. Day after day may be spent in traveling from one ruined town to another without seeing any green thing save a terebinth tree or two standing among the ruins, which have sent their roots down into earth still preserved in the foundations of some ancient building. No soil is visible anywhere except in a few pockets in the rock from which it could not be washed by the torrential rains of the



FIG. 2



FIG. 3

FIG. 2—Serdjillā, a deserted villa town in the Djebel Rihā of Northern Syria (for locations see map, Pl. I).

FIG. 3—Simkhār in the Djebel Sim'an, with a patch of soil held in place by ancient walls. Another ruined town in the distance on the right.

wet season; yet every ruin is surrounded with the remains of presses for the making of oil and wine. Only one oasis has been discovered in these high plateaus. This lies far to the north. It is the site of an ancient town (Fig. 5); olive trees, oaks, and terebinth grow luxuriantly between the ruined walls, and grass covers the flat spaces. A high tower rises in the center of the ruin, so thickly surrounded with trees and underbrush that it is almost impossible to approach it; and here in the midst of dense growth



FIG. 4—The monastery and great church of St. Simeon Stylites in the denuded area of the Djebel Sim'ân.

is a spring which has kept the spot green during centuries. Yet it is so far in the desert that no human beings live here.

THEIR ARCHITECTURE

The architecture of these deserted towns represents at least seven centuries of development and illustrates every variety of structure suitable to a highly developed society. Among the structures that are apparently of very early date, though they have no inscriptions upon them, are buildings in a simple form of polygonal masonry (Fig. 6) with heavy moldings at the top of the walls and massive door frames. Definitely dated buildings of the first and second centuries comprise temples of exquisite workmanship, mostly in ruins because they were preyed upon for building material during the Christian period. There are also fine houses belonging to these centuries in all parts of Syria. The Christian period is represented by churches large and small, little country chapels, public baths

which were often the gifts of wealthy citizens, other public buildings, extensive shops, or bazaars, sumptuous villas, ordinary private houses, and monumental tombs in endless variety.

The churches of the fourth century (Fig. 7) are simple structures with little ornament, but those of the fifth and sixth are more ornate than any Christian buildings before the Gothic period in Europe. Here you will find the ruins of one of the oldest churches, with a chapel of the later



FIG. 5—Shêkh Slêman, the only oasis in the limestone hills of Northern Syria. Its luxuriant vegetation emphasizes the aridity and barrenness which is otherwise the rule in this region. A spring has kept the spot green during centuries, yet it is so far in the desert that no human beings live there now.

period beside it, there a church which was built out of the remains of a pagan temple. The "business architecture" is simple but durable; it consists of such buildings as oil factories, shops, and inns. One finds large hotels, or inns (Fig. 8), named as such in inscriptions, at the chief halting stations on the way to places of pilgrimage and also little wayside inns along the highways. The tomb structures are very numerous and form the most notable collection of mausoleums in the world (Fig. 9).

RUINS IN THE DESERT REGION TOWARD THE EUPHRATES BEND

Passing eastward from this range of hills, one descends into a gently rolling country that stretches miles away toward the Euphrates. At the eastern foot of the hills one finds oneself in a totally different country, at first quite fertile and dotted with frequent villages of flat-roofed houses. Here practically all the remains of ancient times have been destroyed



FIG. 6



FIG. 7

FIGS. 6-9—Examples of the architecture of the deserted towns.

FIG. 6—The earliest type: buildings in a simple form of polygonal masonry.

FIG. 7—One of the oldest churches in Northern Syria, a building of the fourth century at Kharāb Shems.



FIG. 8



FIG. 9

FIG. 8—An inn on the road to St. Simeon's shrine, an example of "business architecture" in Northern Syria.

FIG. 9—One of the splendid tombs of Northern Syria, at Dānā; olive trees in the background.

through ages of building and rebuilding. Beyond this narrow fertile strip the soil grows drier and more barren, until presently another kind of desert is reached, an undulating waste of dead soil. Few walls or towers or arches rise to break the monotony of the unbroken landscape; but the careful explorer will find on closer examination that this region was more thickly populated in antiquity even than the hill country to the west. Every unevenness of the surface marks the site of a town, some of them



FIG. 10—Serakib on the Aleppo-Damascus road, a modern village of domed houses of mud brick (*kubbeh*) characteristic of central Desert Syria. This is a typically Mesopotamian form of domestic architecture, as old as the days of Nebuchadnezzar.

cities of considerable extent. One finds that much sun-dried brick was used in the construction of these ancient buildings and that the stone, which was more sparingly employed, was not limestone but black basalt. One also discovers—the ancient quarries were used as cisterns and are still visible—that the country is underlain with this type of lava. Here and there an arch will be found standing, and an occasional column still marks the ruin of some great structure. All this region, except the parts of it bordering upon the fertile strip along the western edge, is wholly deserted; few even of the wandering Bedouins traverse its dry and wasted steppes. Toward the south, however, in the region of Hama, one begins to encounter villages composed for the most part of domed houses (*kubbeh*) of mud brick (Fig. 10), exactly like those which compose the domestic architecture of the Euphrates country. It is interesting to note that this typically Mesopotamian form of domestic architecture, as old as the days

of Nebuchadnezzar, exists in the middle part of Syria; while all the villages and towns of Northern Syria, like Harim at the extreme northern end of the hills described above (Fig. 11), are built with flat roofs, and the modern villages of the south are of the same general type. In two or three places in this eastern desert district, baked brick and basalt were used in the erection of structures of more than usual magnificence. At Kaşr Ibn Wardân ($35\frac{1}{3}^{\circ}$ N. and $37\frac{1}{5}^{\circ}$ E., Pl. I) there is a group of build-



FIG. 11—Harim, a modern village at the extreme northern end of the limestone hills of northern Desert Syria with flat-roofed houses typical of the architecture of this region.

ings, comprising a beautiful church, an extensive palace, and large barracks, all composed of black basalt and yellow brick of such excellent make that one is tempted to believe that it was imported. Proceeding still farther east and still traversing the desert one comes upon ruins of ancient cities in which the ordinary houses were built of sun-dried brick, but the temples and similar large structures were built of limestone or gypsum. Such is the case at Isriyeh ($35\frac{1}{3}^{\circ}$ N. and 38° E.), one of the most distant points that has been reached in the Syrian Desert.

Southern Syria

THE HAURÂN AND THE LEDJÂ

To explore the unknown areas of Southern Syria the traveler has to cross the wider tract of inhabited territory of Palestine. Passing over Jordan and climbing the hills of Ammon or Gilead, he looks out over the

ancient province of Arabia. Before him lies a wide plain which at its northern end is very fertile and dotted with villages. Beyond the plain, toward the east, rise the volcanic mountains of the Djebel Haurân (Fig. 12); to the north of them lies the lava field of the Ledjâ (Fig. 13), and, far to the south, an undulating region which, though fertile at first, lapses gradually into a desert steppe. The hills on which the traveler is standing are of limestone; but the stone which crops out in the plain, and which constitutes the mass of the mountains beyond and extends



FIG. 12—A view in the Djebel Haurân, the volcanic mountains of Southern Syria, north of Kanawât, il-Mefaleh, a ruin on the hill in the distance.

southward into the steppe, is black basalt. To the northeast of 'Ammân but far out in the steppe, beside the dry bed of the Wâdī il-'Akīb, is the termination of the lava flow (Fig. 14) which poured out of the craters of the Djebel Haurân and underlies the great expanse of the steppe. Beyond this point limestone takes the place of basalt. The plain which lies between the hills east of Jordan and the Djebel Haurân, called the plain of in-Nukra, or the Haurân plain, though populous, has not been well explored. Each village marks the site of an ancient town; but only the more massive of the ancient buildings have survived generations of rebuilding, and these are almost hidden in modern work. Many of the buildings are important, however, and inscriptions abound. The mountainous area of the Djebel Haurân was fairly well explored sixty years ago and is full of wonderful remains of the Nabataean, Roman, and Christian periods; but the ruins here have been inhabited by the Druses for about a century, and the ancient remains are being gradually broken up. The gloomy wastes of the lava fields of the Ledjâ, until recently practically unexplored, are also dotted with ancient towns, some of them of great antiquity; but even this inhospitable land has



FIG. 13



FIG. 14

FIG. 13—Part of the vast lava field of the Ledjā, Southern Syria. Ruins of Kastāl Krēm on the ridge.

FIG. 14—The end of the lava flow which once poured out southward from the craters of the volcanic mountains of the Djebel Haurān. The dry bed in the foreground is the Wādī il-'Akīb.



FIG. 15.—The great ruined city of Umm idj-Djimal, set in the steppe of Southern Syria, the ancient Roman Province of Arabia. The surface is strewn with volcanic scoriae whitened by lichens, so that the black basalt walls and towers of the city appear to rise out of a snow-white sea.



FIG. 16—Burák, an ancient town rising above a dry stream on the eastern slope of the Djebel Haurán.

its population of Druses and Bedouins, and the antiquities are slowly disappearing under the hammers of modern house builders.

RUINS OF THE STEPPE REGION

It is not until one penetrates the dry area to the south and southeast of the mountains that one comes into a land corresponding to the deserted parts of Northern Syria. Here the rolling steppe is strewn with the ruins of large towns and villages that have not been touched since the seventh



FIG. 17—*is-Sâfiyeh* in the southeastern *Djebel Haurân* and its ancient pool during one of the rare wet seasons.

century. An ancient city like *Umm idj-Djimâl*, all in black basalt, stretching level along the desert, is a wonderful sight (Fig. 15). Some of the soil about it has been washed away, leaving the surface thickly strewn with volcanic scoriae which have become covered with fine white lichen, so that the black walls and towers and gaunt arches appear to rise out of a snow-white sea. Many of the towns are spread over the plain; others crown the crests of high ridges directly above the dry beds of ancient streams (Fig. 16). In some cases one finds ancient cisterns that are filled with water in the spring when the snows melt on the mountains to the north (Fig. 17); but the presence of water usually means a settlement, and these are very rare (Fig. 18).

THEIR ARCHITECTURE CONTRASTED WITH THAT OF THE NORTH

The ancient architecture, aside from the Nabataean and Roman temples which are objects of rare beauty of design, is less beautiful and less interesting than the architecture of the north, yet it shows great skill in the art of building (Fig. 19). The types of architecture differ considerably

from those of the north. The temples of the pagan period are more numerous and larger and were richly ornamented; there are occasional theaters and large public baths. The churches are much plainer than those of the north but present a far greater variety of plans. There are a few private houses, villas of more than ordinary magnificence, which outshine the more numerous villas of Northern Syria; but the dwellings of the moderately well-to-do are less attractive. Nevertheless they are no less interesting. Some of the private residences in the larger towns



FIG. 18—The village of 'Anz, in the southern Djebel Haurân, still inhabited because of its perennial water supply.

here in the south were four or five stories high, and they contain various features that are not found in the houses of Northern Syria. Monumental tombs are rare and, with a few exceptions, are not to be compared with the magnificent tombs of the north. All these buildings were constructed entirely of stone and are among the most perfect examples of lithic architecture in the world. On the whole, the civilization seems to have been somewhat different from that of the northern region, yet it was certainly equally advanced.

ANCIENT ROADS AND BRIDGES

Among the most impressive features of the ancient remains in Syria and Arabia are the roads and bridges. These are found from end to end of the entire region. That the roads once existed might have been known from the most ancient road map in existence—a long roll about a foot wide and over twenty-two long—discovered in 1507 and called the *Tabula Peutingeriana*. This interesting document shows the military roads of the Roman Empire from Britain to India. The seas are practically elim-

inated, and the land is much compressed, so that all the principal roads appear to run in parallel lines east and west; they are shown in red lines, with the stations marked by name from town to town and from one military post to another, the number of miles being written in in Roman numerals. The map is believed to date from the fourth century after Christ and to have been drawn from much older sources. Remarkable as is the system of roads, as it appears upon the ancient map, it has been found to be by no means complete so far as Syria is concerned. A number of the principal highways are shown, but many others have been discovered which were equally important but which do not appear. The section of the ancient map showing Syria and the desert eastward, together with a key on which the roads are correctly adjusted to the topographical features, is reproduced herewith (Figs. 20a and 20b). The accuracy of the measurements given on this old map has been tested in many ways; but it was interesting, while drawing the map of ancient Syria, to take two points whose positions were well established but which were separated by unexplored territory, like Palmyra and Rusâfâ (Pl. I), and to apply the ancient road map, placing the towns between them at intervals of as many miles as indicated; for the total number of miles coincides perfectly, and the exact position of ancient towns still undiscovered is established. Wherever the medieval and modern routes of travel coincide with the ancient roads few traces of the old roadbeds are to be discovered, unless it may be that in some of the deep valleys they are buried beneath earth that has washed down from the mountains.

In many of the desert regions the Roman roads are astonishingly well preserved, as may be seen in the accompanying photograph (Fig. 21) showing a section of the road from Antioch to Chalcis at a point where it crosses the desert mountain below Dâna. The road measures over twenty feet in width; some of the blocks of the pavement measure three feet by four feet, and all approximate three feet in thickness. The apparent fissures which are to be seen in the photograph are not really crevices but a growth of yellow lichen spreading out on either side of the joints, which in reality are perfectly tight in most cases. A few miles to the north of the spot where this photograph was taken the road is spanned by a fine arch. This arch, which is of the simplest design, is not to be thought of as a triumphal arch but more probably as a toll gate; for it stands very near an inscribed stone which marks the boundary between two administrative divisions of Northern Syria. There are several complete Roman bridges in Northern Syria and many medieval, or comparatively modern, bridges that are built on Roman piers. Some of these, like Djisr il-Medjdal just northwest of Hama (Fig. 22), which spans an often dry branch of the Orontes, are composed of four or five arches. A beautiful bridge of three arches crossing a mountain torrent is the one over the Dog River, Nahr il-Kelb. I happened to see this bridge a few weeks after a great flood had

carried away a new bridge for a carriage road and a railroad bridge, both of which were built by French engineers a short distance down the stream, and was glad to pay my respects to the shades of the Roman engineers of the first century.

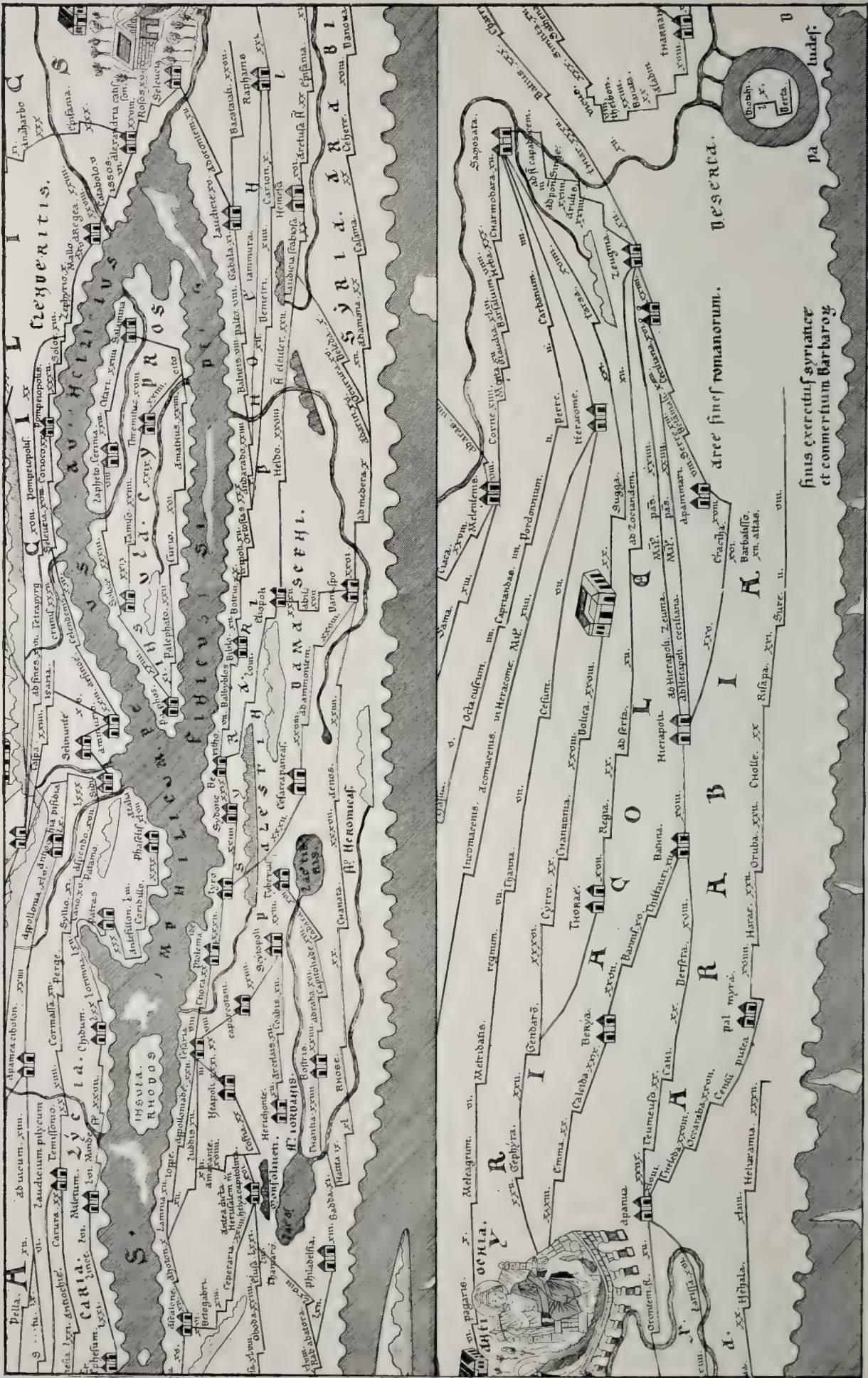
NEW LIGHT ON ROMAN ROAD CONSTRUCTION

The roads in Southern Syria, the old Arabian province, are often found in a wonderful state of preservation in the desert steppes; but they are less interesting as subjects for photography. Long sections of



FIG. 19—The monastery of Umm il-Kuttên, south of the Djebel Haurân, typical architecture of the Christian period in Southern Syria.

Trajan's great road, built in A. D. 114 and extending from Bosrâ to the Red Sea, are absolutely intact, with milestones standing or lying at every mile; and these intact sections shed entirely new light upon Roman road construction, for they show not only the paving but an elastic top covering above the pavement. As in other Roman roads in this province, the roadbed is about twenty feet wide and is divided into two equal paths by a sort of dorsal ridge composed of a row of stones which rise from five to seven inches above the pavement. The material is entirely black basalt. The pavement is evenly laid in comparatively small blocks of basalt, like irregular polygonal masonry. The roadbed slopes gently from the medial ridge to the outer edges, where it is bound in by a row of stones which protrude from five to seven inches above the pavement. All these features are well known in Roman road making; but here in the desert there are many sections in which an unsuspected feature appears, that is a filling of volcanic cinders four inches deep under a layer of beaten clay which brings the level of the road to the top of the bounding stones, sloping gently from the dorsal ridge. One often observes



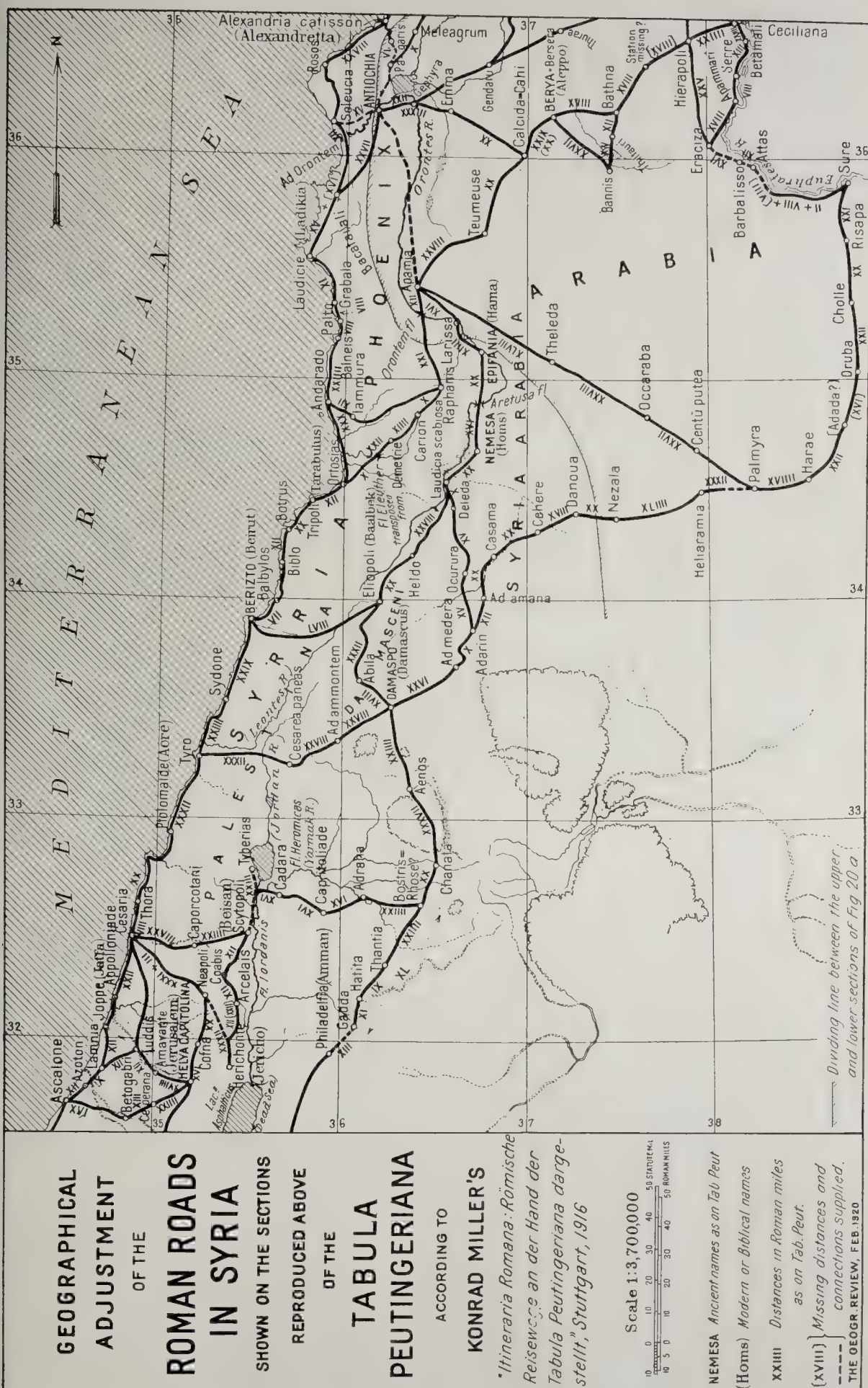


FIG. 20b

pedestrians and drivers of animals forsaking a paved road for the strip of natural soil beside it and has often wondered how the Roman armies and the animals which carried or drew the commerce of ancient times endured the hard pavements; but this discovery of an elastic surface which was perhaps a feature of all, or most, of these roads solves the problem completely.

The bridges of the Arabian province are quite as numerous as those of Northern Syria. They are of slightly different construction owing to the difference of material, for basalt takes the place of limestone. Many



FIG. 21—A section of the Roman road in the desert hills between Antioch and Chalcis, Northern Syria.

of them span the beds of streams that seldom or never have water in them and give clear evidence of the great climatic changes that have taken place (Fig. 23). The remains of these roads and bridges, found in disconnected pieces of pavement, scattered milestones, and ruined piers in the dry stream beds over the length and breadth of the deserted parts of Syria and Arabia, show that there was in ancient times a perfect network of well-built roads, far more in number than those shown on the ancient map. The main arteries were perhaps primarily for the mobilization of troops; those leading toward the limits of the empire were undoubtedly for defense; but a very large number of these roads were for convenience and were directly connected with facilities for transportation, communication, and trade between the communities.

Ancient Inhabitants of the Region

HIGH STATE OF CIVILIZATION

But who were the inhabitants of these hundreds of deserted towns? Who were the men and women that traveled over these roads, maintained the temples, sat in the theaters, attended the churches, patronized the

baths, lived in these fine houses, and were buried in these splendid tombs? The brief description given above of the tangible remains which it has left behind is sufficient proof that the civilization of Syria and Arabia had reached a very high state indeed; and more could be written to show that it had not passed its zenith, had not known the beginnings of decline, but was still in the ascendant when it was cut off by untoward external forces. The people of this country had an art of their own, influenced for a time by Greek teaching and direction but eventually returning to its original forms of expression, enriched by foreign elements, and develop-



FIG. 22—Roman bridge, Djisir il-Medjdal, northwest of Hama, Northern Syria.

ing into a style in advance of the art of other parts of the world at the time. They likewise had languages of their own, Syriac in the north and Arabic in the south, which yielded for a while to Greek in certain important fields but which had begun to revive under a new stimulus of national or racial feeling. It is plain from a comprehensive study of their architecture and other arts, found in their ruined towns and represented in objects from their tombs, that the ancient population of these regions was composed in large part of an intelligent, well-to-do middle class. If the domestic architecture of a people may be taken as an index to their culture—and I believe it may be, in spite of the danger of an invidious modern application—the culture of the Syrians was exceptionally high. If many of their inscriptions leave much to be desired in matters of spelling and grammatical construction, one must recall the fact that the writers were using a foreign language, which modern scholars know more about than did even the Greeks themselves.

ECONOMIC CONDITIONS

That they were well-to-do is evident from inscriptions which prove that they had enough and to spare of this world's goods. In more than one

place a citizen presents a public bath to his city, in others a church or a monastery is erected at private expense. Less wealthy citizens gave doorways or other features to the village churches. The inscriptions show that buildings were often erected at public expense.

Their society was peaceful and well ordered, for many of the most sumptuous villas stand in groups with no surrounding town walls to protect them, and only a few of the smaller and more ancient places had town walls formed by joining up the rear walls of houses. It is only out toward the Euphrates in the north, and on the farthest eastern confines in the south, that one finds walled towns, fortresses, and barracks, as precautions against the Parthians or Persians on the one hand or the desert tribes on the other.

The inhabitants could not have been large landowners—the towns are placed too closely together for this; and for the same reason they could not have been possessed of large herds of cattle or flocks of sheep. But the remains tell us that they raised olives and grapes and made oil and wine on a large scale, especially in the north; for there are enclosures, with rows upon rows of plain upright posts of stone, which were unquestionably vineyards; and there are hundreds of rock-hewn oil and wine presses, to say nothing of buildings erected to house large presses, and inscriptions which designate one house as a wine press and another as an oil factory. These commodities were produced in quantities more than sufficient for local consumption, one would suppose, and were probably exported to Antioch and other large cities and perhaps overseas.

Many towns are composed almost entirely of shops or bazaars. Trade undoubtedly flourished between these Syrian towns and the towns on the coast, as well as with countries lying to the east. In the south the caravan trade with Arabia, Egypt, and Persia must have developed a large body of merchants. In one of the inscriptions a man records the fact that he has taken a caravan out to the Indus; in another a citizen boasts that he had been on an embassy to Rome. As merchants and traders, then, and as producers of oil and wine we may think of the early dwellers in these long-deserted cities and towns; as being in touch with East and West, with North and South, by commerce carried on over excellent roads, living in peace among orderly surroundings; not oppressed by taxation to a point where they were unable to surround themselves with a considerable amount of luxury, and enjoying many comforts and conveniences which were denied to, or unsought by, the middle classes of continental Europe until very recent times (I refer to baths and water closets) and are still beyond the reach of the less progressive countries.

ABRUPT END OF THIS CIVILIZATION

It may be asked, "What brought this great civilization, so modern in many of its aspects, to so sudden and complete an end?" The question

cannot be answered offhand. One knows from history of two disastrous wars of invasion, that of the Persians from the east and that of the Arabs, or Saracens, from the south in the first third of the seventh century. One is told that it was the custom of the Persians to lay waste a wide strip of territory between themselves and those whom they had defeated if they failed to occupy that territory. The conquerors may have cut down the olive groves and the vines; they may even have wrecked the presses and the terrace walls. There are many signs of looked-for



FIG. 23—Roman bridge over the dry Wâdi Zêdi, north of the ancient town of Bostra, Southern Syria. The fact that many of the Roman bridges span the beds of streams that seldom or never have water in them now gives clear evidence of the great climatic changes that have taken place.

trouble from the east in the strengthening of old fortifications and the building of new ones out toward the Euphrates during the last quarter of the sixth century. But, allowing for two bloody wars in close succession, allowing for much destruction on the part of the victors, and for deportations and a general exodus of the population, no human hands were ever able to transform a fertile, populous, and thriving country into a desert in so short a time. We must look for great natural changes as well, changes induced perhaps and hastened by the activities of man.

DESICCATION AS A CAUSE

We may draw certain very definite conclusions as to the former conditions of the country itself. There was soil upon the northern hills where none now exists, for the buildings now show unfinished foundation courses which were not intended to be seen; the soil in depressions without outlets is deeper than it formerly was; there are hundreds of olive and wine presses in localities where no tree or vine could now find footing; and

there are hillsides with ruined terrace walls rising one above the other with no sign of earth near them. There was also a large natural water supply. In the north as well as in the south we find the dry beds of rivers, streams, and brooks with sand and pebbles and well-worn rocks



FIG. 24—A type of the Hauwarni, settled Moslem Arabs living in the plain of in-Nukra south of Damascus.

but no water in them from one year's end to the next. We find bridges (Fig. 23) over these dry streams and crudely made washing boards along their banks directly below deserted towns. There are well heads and well houses, spring houses, and inscriptions referring to springs; but neither wells nor springs exist today except in the rarest instances. Many of the houses had their rock-hewn cisterns, never large enough to have supplied water for more than a brief period, and corresponding to the cisterns which most of our recent forefathers had which were for convenience rather than for dependence. Some of the towns in Southern Syria and one or two in Northern Syria were provided with large public reservoirs; but these are not large enough to have supplied water to their original populations. The high plateaus were of course without irrigation; but there are no

signs, even in the lower flatter country, that irrigation was ever practiced; and canals for this purpose could not have completely disappeared. There were forests in the immediate vicinity, forests producing timbers of great length and thickness; for in the north and northeast practically all the buildings had wooden roofs, wooden intermediate floors, and other features of wood. Costly buildings, such as temples and churches, employed large wooden beams; but wood was used in much larger quantities in private dwellings, shops, stables, and barns. If wood had not been plentiful and cheap—which means grown near by—the builders would have adopted the building methods of their neighbors in the south, who used very little wood and developed the most perfect type of lithic architecture the world has

ever seen. And here there exists a strange anomaly : Northern Syria, where so much wood was employed in antiquity, is absolutely treeless now ; while in the mountains of Southern Syria, where wood must have been scarce in antiquity to have forced upon the inhabitants an almost exclusive use of stone, there are still groves of scrub oak and pine, and travelers of half a



FIG. 25—A Druse sheikh of the Ledjā.

century ago reported large forests of chestnut trees. Whatever plausibility may attach to the theory that the loss of forests means a reduction of rainfall, it is perfectly apparent that large parts of Syria once had soil and forests and springs and rivers, while it has none of these now, and that it had a much larger and better distributed rainfall in ancient times than it has now. It would appear that the inhabitants used up a large part of their forests for building purposes and for charcoal; if they allowed sheep and goats to pasture where the forests had been, the hills could not reforest themselves. The olive groves and the terraces would do much to hold the soil on the hillside; but when these were destroyed there was nothing to prevent the utter denudation of the mountains.

HUNTINGTON'S CLIMATIC PULSATIONS

Dr. Ellsworth Huntington in his most interesting book, "Palestine and Its Transformation,"¹ depending in part at least upon the observations of the American Archaeological Expedition to Syria of 1899-1900 and the Princeton Archaeological Expeditions of 1904-05 and 1909, has evolved a theory of pulsations of climatic conditions from wet to dry and from dry to wet through many generations, each dry period leaving the country poorer than the last one. In so far as this theory was based upon observations of mine which pointed to a complete lack of inscriptions and to a cessation of building activity between the years 252 and 324



FIG. 26—The Shêkh id-Dîn, or religious head, of the Druses of the Djebel Haurân, and his body guard.

A. D., I am now obliged to limit it; for the reason that later observations in all parts of deserted Syria have brought to light fourteen inscriptions evenly distributed over those seventy-two years—a number just equal to that of the building inscriptions bearing dates during the seventy-five preceding years. Moreover, Dr. Huntington's statement that there was a revival of building activity in Syria by the Arabs after the year 610, so far as it depends upon statements given out by me, is a little misleading. The evidence of Arab building activity is very scant. We have perhaps four examples of edifices erected under the Ommayyads in the eighth century, all with a very limited area. There were numerous Arab castles erected throughout the length and breadth of Syria in the eleventh and twelfth centuries, and there are also a few places in which medieval Arab tombstones are found. But Arab civilization was confined to a very small

¹ Chapter 13 and especially pp. 334-336 of Chapter 14.

number of places compared with the number of towns where there are no signs of Arab occupation. A vast majority of the cities and towns of Christian Syria appear to have been deserted early in the seventh century and to have remained uninhabited and in ruins ever since.

Present Inhabitants

THE NORTHERN REGION

But who are the present inhabitants of these waste places of Syria? For I have said that there are a few natives with sufficient hardihood to



FIG. 27—Druse types, armed and unarmed.

face the dangers of starvation in some of these otherwise uninhabited regions. The northernmost hills of limestone are all but deserted. At certain seasons small groups of Turkoman tents are to be seen in a few of the ruined towns, and settlements of two or three families of Kurds are sequestered in a few others; but most of the ruins are entirely deserted. In the limestone hills to the east of the Orontes there are small and extremely poor villages, often within the ruined towns. Their inhabitants are Arabic-speaking peasants of the most wretched class, but a few of them are Druses. These settlers do not live in the ancient buildings but build their hovels among them, using old material. To the east lies a plain through which the highway runs. Here there are soil and vegetation and hence cultivation of varying width; for the desert begins only a little to the east of the road, and there are small towns and villages of fair size where the inhabitants are willing to stake their lives on the chance of an occasional moist season with good crops. But the great

tract stretching beyond this far out toward the Euphrates is entirely a desert, and few even of the nomadic Arabs visit it. As one travels southward along the narrow cultivated strip bordering the desert and at the foot of the mountains, one begins to encounter a more mixed population as soon as one passes the region of Hama. Here are not only villages of the usual Moslem *fellahîn*, or peasantry, but also an ever increasing number of Circassian villages, usually better built and cleaner than the others, and a few large villages of Christians of the old Jacobite sect—sequestered



FIG. 28—Druses of the younger generation.

spots in which the ancient Syriac tongue is still spoken and in which the schismatic sect founded by Jacobus Baradaeus in the fifth century still uses its Early Christian liturgy.

THE SOUTHERN REGION

South of Damascus the rich plain of in-Nukra is peopled by settled Moslem Arabs called Hauwarni (Fig. 24) and a few Christians, a poor and oppressed peasantry living in wretched villages in the midst of teeming fields of grain. Each village marks the site of an ancient town, and fragments of fine architectural monuments are to be seen in every one of them. The villages in the foothills to the west are occupied chiefly by Circassians imported by the Sultan Abdul Hamid, armed by him, and put in possession of the best water sources as a sort of buffer against the Arabs.

THE DRUSES

To the east, the mountains of the Haurân are entirely populated by the Druses; the mountains are often called the Djebel id-Drûz. This most

interesting sect, which might almost be called a little nation, are comparatively new comers. They speak only Arabic; but in color, features, build, and manners they are unlike their neighbors. In their mountain fastnesses they have maintained virtual independence of the Turks, are monogamous, and have a secret religion. They are ruled in patriarchal fashion by a number of chiefs (Fig. 25) whose power is very great. Their mountain is not so bare of soil as the northern mountains are, though there is less soil here now than in ancient times, and their life is not a particu-



FIG. 29—Christian Bedouins of the steppe, Southern Syria.

larly hard one. They own large flocks and herds which are cared for by dependent tribes of Bedouins, who take them to the Djôf in winter; their houses are large and quite comfortable, and the great sheikhs live a life that makes one think of Job in his days of prosperity. It seems strange, after traveling among the dark-skinned Bedouins and the swarthy *fellahîn*, to come upon these strangers, among whom one sees so many faces that would not look out of place in northern Europe or even in a New England village. Their Shêkh id-Dîn, or religious head, is a man with fair complexion and reddish hair (Fig. 26), fine courtly manners, and no little learning. Their dress is in part peculiar to themselves and partly copied from the Bedouins (Figs. 27 and 28).

CHRISTIAN BEDOUINS

The lava fields of the Ledjâ to the north of the Djebel Haurân are partly inhabited; in some localities by Druses living in well-built villages, in others by Bedouins who have pitched their tents among the ancient ruins. The great rolling steppe to the south, which was once a very

productive area, has a few Druse villages at the foot of the mountain; but beyond these it has no settled population and affords only scant pasture for the great tribes in their migrations. Here it was astonishing to encounter a small group of Christian Bedouins (Fig. 29) who said they were representatives of a small tribe. They appear to have a primitive form of Christianity and are monogamous. They regret that they have "lost the priesthood," as they say, and that their "graves are unblest"; but they seek out a Christian village, from time to time, or find some wandering Greek priest and have their marriages, which are made legal by the sheikh, blessed and their numerous children baptized, often five or six at one time.

CONTRAST OF PRESENT AND PAST

One cannot fail to contrast these present conditions of life and of civilization with those of the glorious past. In the wholly deserted towns, where the silence of death reigns and the gaunt wrecks of once mighty edifices stand as tombstones above a people's grave, the contrast is strong enough; but, wherever there are signs of life still struggling against the tremendous odds which nature imposes, the contrast is stronger still. Only misery, want, and ignorance exist today in the place of former opulence, comfort, and culture. The villages of the Druses are the only exception to these conditions; for the Druses hold their heads high, greet the stranger as a distinguished guest, and entertain him like lords. Their houses, though crude, are often comfortable, their carpets and cushions rich, and their clothes often magnificent. But everywhere else where there are people living among the ruins—men, women, and little children—one finds a cowed, frightened, suspicious, and superstitious race reduced to most abject poverty, living in hovels composed in part of fragments of exquisitely chiseled stonework with inscriptions setting forth the wealth and culture of the original inhabitants; and this shocking change has taken place in thirteen centuries, partly no doubt through natural causes, but in large measure through evil government.



MAP OF SYRIA IN THE IV-VI CENTURIES

SCALE 1:1,250,000
5 10 15 20 25 30 35 40 45 Roman miles
5 10 15 20 25 30 35 40 45 Statute miles

- Walled cities now inhabited.
- Walled cities now deserted.
- Ancient fortresses.
- Roman Roads drawn from remains.
- Ancient " " descriptions.
- Probable courses of ancient roads.
- Ancient Bridges completely or partly preserved.
- Roman miles according to Tabula Peutingeriana.
- Inhabited towns with ancient buildings.
- Ancient towns now deserted.
- sites now inhabited.

ANTILLIA AND THE ANTILLES

By WILLIAM H. BABCOCK

There are two names still in common use for American regions, which long antedate Columbus and most likely commemorate achievements of earlier explorers. They are Brazil and the Antilles. The former is earlier on the maps and records; but the case for Antillia, as an American pre-Columbian map item, is in some respects less complex and more obvious.

ANTILLIA

A good many decades before the New World became known as such, Antillia was recognized as a legitimate geographical feature. A comparatively late and generally familiar instance of such mention occurs in Toscanelli's letter of 1474 to Columbus, recommending this island as a convenient resting point on the sea route to Cathay.

Nordenskiöld in his elaborate and invaluable "Periplus" declares: "As the mention of this large island, the name of which was afterwards given to the Antilles, in the portolanos of the fourteenth century, is probably owing to some vessel being storm-driven across the Atlantic (as, according to Behaim, happened to a Spanish vessel in 1414), those maps on which this island is marked must be reckoned as Americana."¹ The word "fourteenth" is probably an accidental substitute for "fifteenth." The reference to Behaim undoubtedly means the often-quoted inscription on his globe of 1492, which avers that "1414 a ship from Spain got nighest it without being endangered."² This seems to record an approach rather than an actual landing. But at least it was evidently believed that Antillia had been nearly reached in that year by a vessel sailing from the Iberian Peninsula. Little distinction would at that time have been made between Spain and Portugal in such a reference by a non-Iberian.

Ruyseh's map of 1508 is a little more vague in its Antillia inscription as to the time of this adventure.³ He says it was discovered by the Spaniards long ago; but perhaps this means a rediscovery, for he also chronicles the refuge sought there by King Roderick in the eighth century.

PETER MARTYR'S IDENTIFICATION OF ANTILLIA

Both of these representations show Antillia far in the ocean dissociated from any other land, but in the work of Peter Martyr d'Anghiera, con-

¹ A. E. Nordenskiöld: *Periplus: An Essay on the Early History of Charts and Sailing-Directions*, transl. by F. A. Bather, Stockholm, 1897, p. 177.

² E. G. Ravenstein: *Martin Behaim: His Life and His Globe*, London, 1908, p. 77.

³ A. E. Nordenskiöld: *Facsimile-Atlas to the Early History of Cartography*, transl. by J. A. Ekelöf and C. R. Markham, Stockholm, 1889, p. 65 and Pl. 32.

temporary and historian of Columbus, writing before 1511, we have an explicit identification as part of a well-known group or archipelago. He has been narrating the discovery of Cuba and Hispaniola and proceeds: "Turning, therefore, the sterns of his ships toward the east, he assumed that he had found Ophir, whither Solomon's ships sailed for gold, but, the descriptions of the cosmographers well considered, it seemeth that both these and the other islands adjoining are the islands of Antillia."⁴ Perhaps he meant delineations, like those we have yet to consider, and not descriptions in words; or writings concerning these islands may then have been extant which have since vanished as completely as the celebrated map of Toscanelli.

Among "the other islands adjoining" we may be sure he included that island of Beimini or Bimini (no other than Florida), a part of which, thus marked, occurs in his accompanying map and has the distinction of owning the fabled fountain of youth and luring Ponce de Leon into romantic but futile adventure. Perhaps only one other map gives it the name Bimini; but its insular character is plain on many maps (made before men learned better), with varying areas and under different names.

OTHER IDENTIFICATIONS

Peter Martyr was not alone in his identification of the "islands of Antillia." Canerio's map,⁵ attributed to 1502, names the large West India group "Antilhas del Rey de Castella," though giving the name Isabella to the chief island; and another map of about the same date (anonymous) gives them the collective title of Antilie, though calling the Queen of the Antilles Cuba, as now. A later map,⁶ probably about 1518, varies the first form slightly to "Atilhas [i. e. Antilhas] de Castela" and shows also "Tera Bimini." This is the second Bimini map above referred to.

It is true that the name Antillia, often slightly modified, was not restricted to this use but occasionally was applied in other quarters. Beside Behaim's globe and Ruysch's map already mentioned, a Catalan map of the fifteenth century (obviously earlier than the knowledge of the Portuguese rediscovery of Flores and Corvo)⁷ presents a duplicate delineation of most of the Azores, giving the supposed additional islands a quite correct slant northwestward and individual names selected impartially from divers sources. One of these is Attiaela, recalling the doubtful "Atilae"

⁴ Pietro Martyr d'Anghiera: *The Decades of the New World or West India*, transl. by Rycharde Eden, London, 1597, First Decade, p. 6.

⁵ K. Kretschmer: *Die Entdeckung Amerikas in ihrer Bedeutung für die Geschichte des Weltbildes*, 2 vols. (text and atlas), Berlin, 1892; atlas, Pl. 8, map 1, for Canerio, map 2 for the other of like date.

⁶ Friedrich Kunstmann: *Ueber einige der ältesten Karten Amerikas*, pp. 125-151 in his "Die Entdeckung Amerikas, nach den ältesten Quellen geschichtlich dargestellt," with an atlas: *Atlas zur Entdeckungsgeschichte Amerikas*, aus Handschriften der K. Hof- und Staats-Bibliothek, der K. Universitaet und des Hauptconservatoriums der K. B. Armee herausgegeben von Friedrich Kunstmann, Karl von Spruner, Georg M. Thomas, Royal Bavarian Academy of Sciences, Munich, 1859; reference on Pl. 4 of atlas.

⁷ Theobald Fischer: *Sammlung mittelalterlicher Welt- und Seekarten italienischen Ursprungs*, 1 vol. of text and 17 portfolios containing photographs of maps, Venice, 1877-86; reference in Portfolio XIII, Pl. 5.

of the map of the Pizigani of 1367,⁸ which may have suggested it, being applied in the same or a neighboring region. The islands remain mysterious, perhaps merely registering a free range of fancy at divers periods.

AN ANTILLIA OF THE MAINLAND

Again, at a much later time, when the exploration of the South American coast line had proceeded far enough to demonstrate the existence of a continent, some one speculated, it would seem, concerning an Antillia of the mainland. The Schuller manuscripts of the Library of Congress contain a copy, in part reproduced herewith (Fig. 1), of a map presumably included in the Egerton manuscripts of the British Museum and marginally marked in Dr. Schuller's handwriting "The Egerton, about 1509 or 1510." This bears the word "Antiglia" running from north to south at a considerable distance west of the mouth of the Amazon, apparently about where would now be the southeastern part of Venezuela.

Also, Egerton Manuscript 2803 (about 1520) bears "Antiglia" as a South American name, in this instance moved farther westward to the region of eastern Ecuador and neighboring territory. A section of the map showing this is reproduced herewith (Fig. 2).

But these aberrant applications of the name Antillia in its various forms were mostly late in time and probably all suggested by some novel geographical disclosures. The standard identification, at least from Beccario's map of 1435 to Benincasa's map of 1482, was with a great group of western islands; as was Peter Martyr's, much later.

THE ORIGIN OF THE NAME

Naturally the origin of the word has been found a fascinating problem. Ever since Formaleoni,⁹ near the close of the eighteenth century, called attention to the delineation of Antillia in Bianco's map of 1436 as indicating some knowledge of America, there have been those to urge the claims of the suppositional lost Atlantis instead. The two island names certainly begin with "A" and utilize "t," "l," and "i" about equally; but "Atlantis" comes so easily out of "Atlas," and the great mountain chain marches so conspicuously down to the sea in all early maps, that the derivation of the former may be called obvious; whereas you cannot readily or naturally turn "Atlas" into "Antillia," and there is no evidence that any one ever did so. As to geographical items, both have been located in the great western sea; but that is true of many other lands, real or fanciful. Something has been made of the elongated quadrilateral form of Antillia; but Humboldt points out that in the description transmitted by Plato this

⁸ [E. F.] Jomard: *Les monuments de la géographie, ou recueil d'anciennes cartes européennes et orientales*, Paris, [1842-62], Pl. X, 1.

⁹ Vicenzio Formaleoni: *Description de deux cartes anciennes tirées de la Bibliothèque de St. Marc à Venise*, pp. 91-168 of the same author's "Essai sur la marine ancienne des Vénitiens," transl. by the Chevalier d'Henin, Venice, 1788; reference on p. 122 and Pl. III.

outline is ascribed to a particular district in Atlantis, not to the great island as a whole, and that, even if it could be understood in the latter sense, there seems no reason why a fragment surviving the great cataclysm should repeat the configuration of Atlantis as a whole. There seems a total lack of any direct evidence, or any weighty inferential evidence, of the derivation of Antillia from Atlantis.

HUMBOLDT'S HYPOTHESIS

Humboldt, in rejecting this hypothesis, advanced another, which is picturesque and ingenious but hardly better supported.¹⁰ His choice is

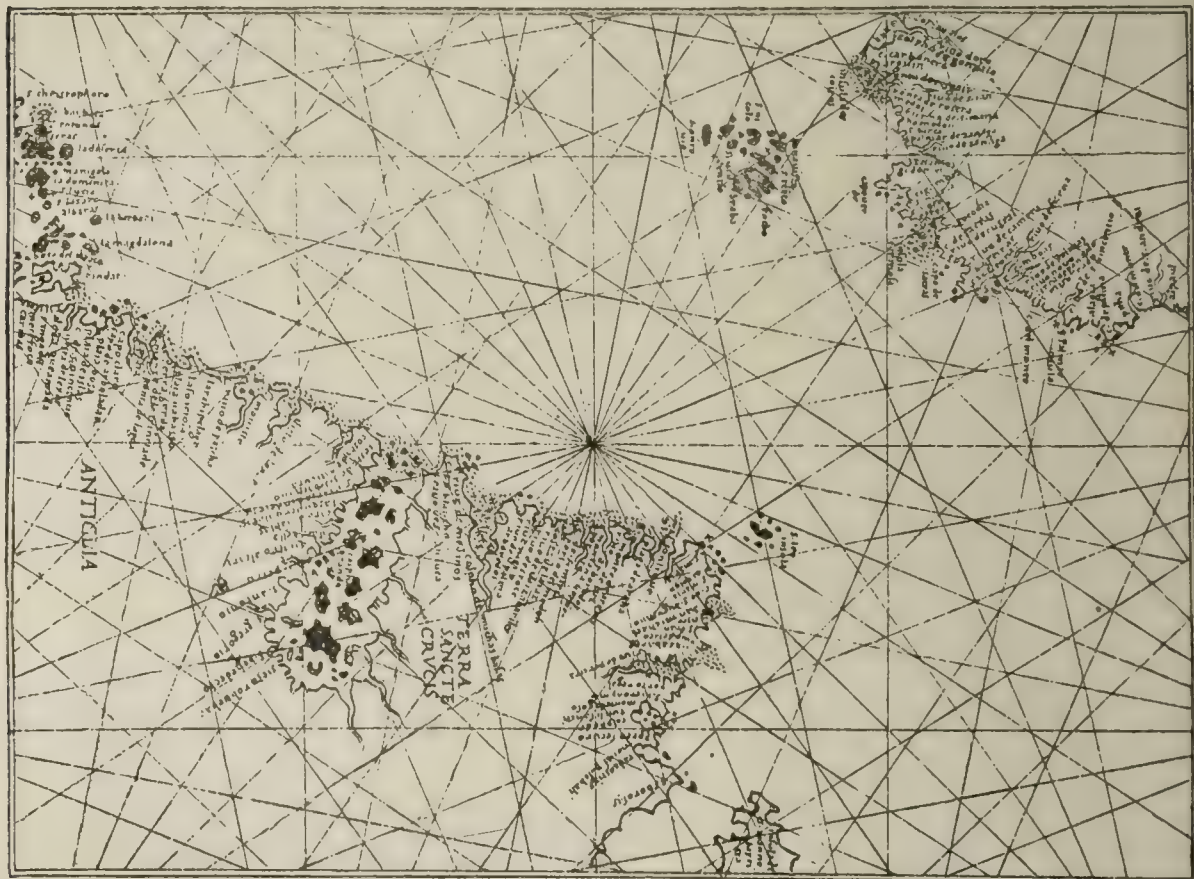


FIG. 1—Section of an anonymous map of about 1509-1510 (Egerton MSS., British Museum) showing the name "Antiglia" applied to a region in the interior of South America. (From copy in Schuller manuscripts, Manuscript Division, Library of Congress, Washington, D. C.)

"Al-tin," Arabic for "the dragon." Undoubtedly Arabs navigated to some extent some parts of the great Sea of Darkness, and these monsters were among its generally credited terrors. The hardly decipherable inscriptions in the neighborhood of an island on the map of the Pizigani of 1367 seem to cite Arabic experience in proof of perils from *fulvos* (krakens) rising from the depths of the sea, coupling dragons with them in the same legend and illustrating it by a picture of a kraken dragging one seaman overboard from a ship in distress, while a dragon high overhead flies away with

¹⁰ A. von Humboldt: *Examen critique de l'histoire de la géographie du Nouveau Continent*, 5 vols., Paris, 1836-37; reference in Vol. 2, p. 211. The other mentions of Humboldt in this article refer to the same volume, pp. 178-211, except allusions to his correspondence with the Weimar librarian.

another. It is even true that Arabic tradition established a dragon on at least one island as a horrible oppression, long ago happily ended, and that another island (perhaps more than one) was known as the Island of the Dragon. But in all this there is nothing to connect dragons with Antillia, and that most hideous medieval fancy is out of all congruity with the fair and almost holy repute of this island as the place of refuge of the last Christian ante-Moorish monarch of Spain in the hour of his despair and as the new home of the seven Portuguese bishops with their following.

In passing, we may note that Antela, the version of the Laon globe

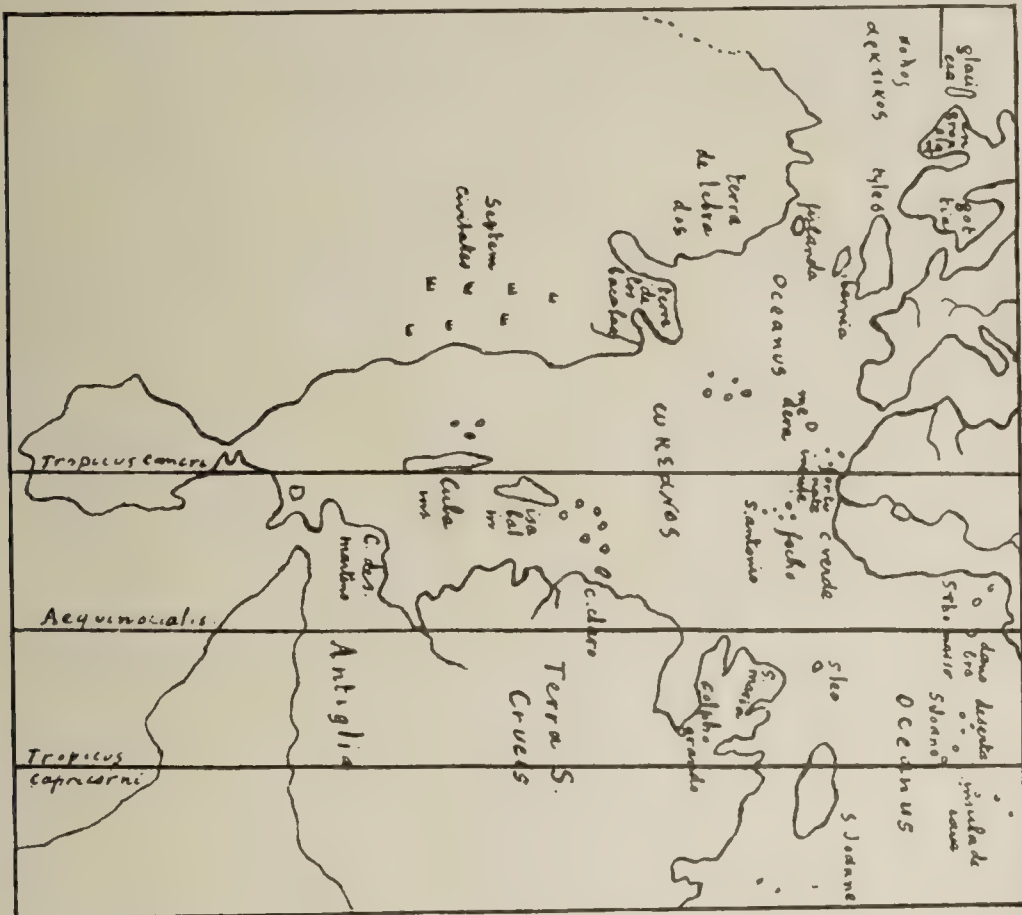


FIG. 2—Section of an anonymous world map of about 1520 (Egerton MS. 2803, British Museum) likewise showing the name Antiglia in the interior of South America. (A similar section of this map, of which a copy is in the Schuller manuscripts at the Library of Congress, was reproduced in the *Geogr. Rev.*, Vol. 7, 1919, p. 102.)

hereinafter referred to, is identical with the name of that Lake Antela of northwestern Spain which is the source of the river Limia, fabled to be no other than Lethe, so that Roman soldiers drew back from it, fearing the waters of oblivion. But as yet no one has taken up the cause of Spanish Antela as the origin of the island's name. Probably it is a mere matter of coincidence.

Humboldt admits that Antillia may be readily resolved into two Portuguese words, *ante* and *illa* (island). He even cites several parallel cases, of which Anti-bacchus will serve as an example. But he objects that such compound names have been used in comparison with other islands, not with

a continent. In the present instance, however, the comparison would be with Portugal, not with all Europe, and the other member of it would be a map island which, he says, is as long as Portugal and seems curiously to borrow and copy Portugal's general form and is arranged opposite to that kingdom far beyond the Azores across a great expanse of sea. It must be remembered that *illa* is the old form of *ilha*, found in many maps, that either would naturally be pronounced "illia," and that you cannot say "antillia" or "anti-illia" at all rapidly without turning it almost exactly into Antillia. The "island out before," or the "opposite island," would be the natural interpretation. The latter seems preferable. Notwithstanding the great importance which must always be attached to any opinion of Humboldt's, there really seems no need to let fancy range far afield when an obvious explanation faces us in the word itself and on the maps.

THE WEIMAR MAP

Nordenskiöld, practically applying his test of the presence of Antillia and arranging his materials in chronological order, heads his list of "The Oldest Maps of the New Hemisphere"¹¹ with the anonymous map preserved in the Grand Ducal library in Weimar and credited to 1424.¹² But it seems that this map does not deserve that position, for it is not entitled to the date; Humboldt, inspecting the original, made out certain fragments of words and the Roman characters for that year on a band running from south to north between the Azores and Antillia; also, in more modern ink, the date 1424 on the margin. Whatever the explanation, he was convinced of error by subsequent correspondence with the Weimar librarian and admitted that it was probably the work of Conde Freducci not earlier than 1481. Apart from all considerations of workmanship and map outlines, the use of "insule" instead of "insulle" and of "brandani" instead of "brandany" in the inscription concerning the Madeiras marks the map as almost certainly belonging to the last quarter, not the first quarter, of the fifteenth century.

THE BECCARIO MAP OF 1426

The second map on Nordenskiöld's New World list is "Becharius 1426," a Latinization of the surname of Battista Beccario and at least not so weird a transformation as Humboldt's "Beclario or Bedrazio." Apparently the year of this map has not been doubted, but there is a lack of first-hand evidence that the original contains Antillia. No reproduction of this map had been published prior to the writer's paper on St. Brendan's Islands in the July, 1919, *Geographical Review*, nor, so far as I know, has its extreme western part been copied in any way. The section there reproduced (Pl. I) is one of several sent me in response to arrangements, made

¹¹ Periplus, p. 177.

¹² W. H. Babcock: Indications of Visits of White Men to America before Columbus, *Proc. 19th Internatl. Congr. of Americanists, Held at Washington, Dec. 27-31, 1915*, [Smithsonian Institution,] Washington, D. C., 1917, map on p. 476.

before the war, for a photograph of the map, but by some mistake the very portion that would have been conclusive was omitted, and all attempts to remedy the error have failed. But, if there were any inscription concerning recently discovered islands located as in his later map, some part of it at least would probably be seen on what I have; and for this and other reasons I do not believe that Antillia is delineated or named on the Beccario map of 1426.

THE BECCARIO MAP OF 1435

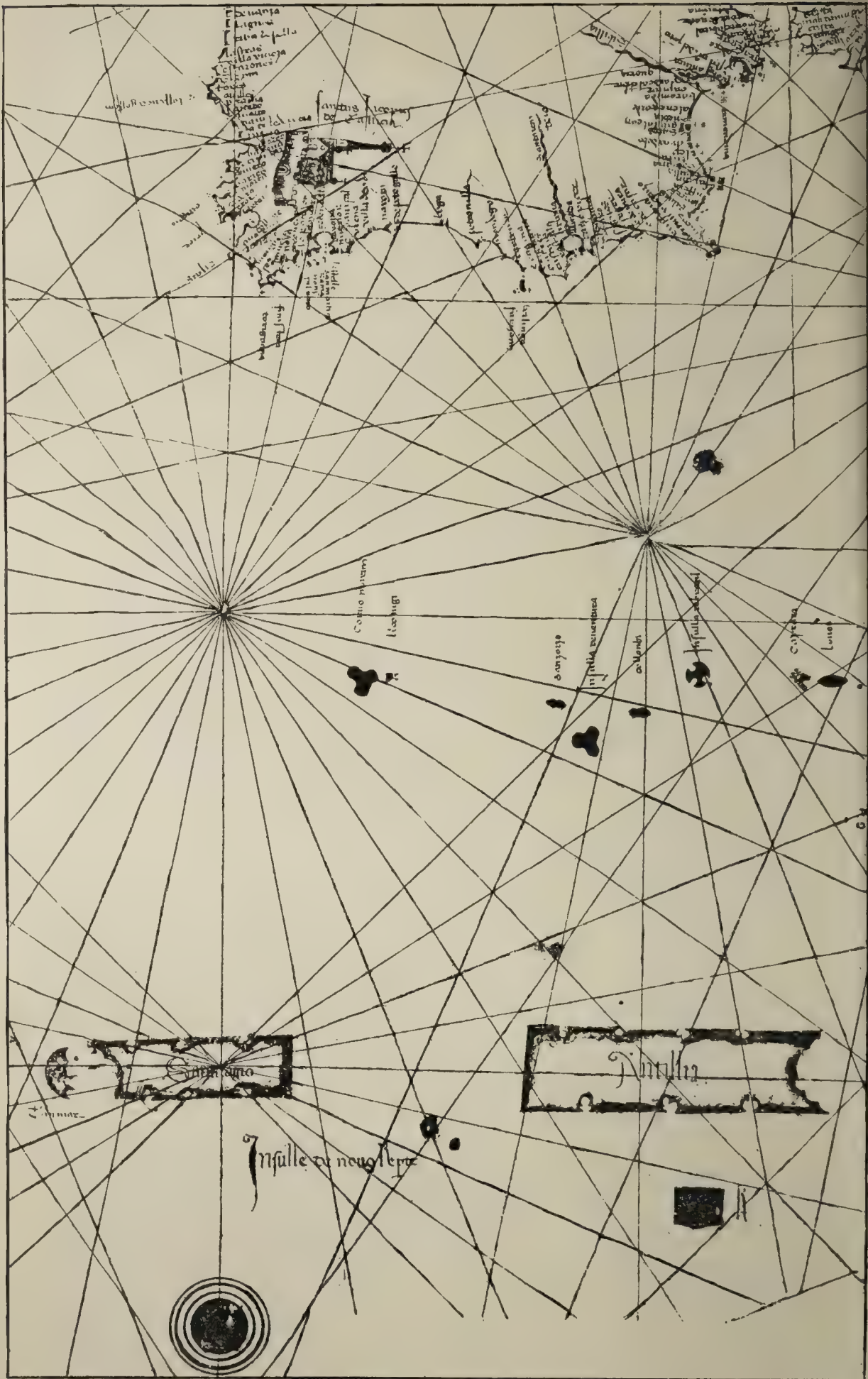
The addition to fifteenth-century geography of a great group of large western islands roughly corresponding to a part of the West Indies and Florida rests mainly on the testimony of the following maps: Beccario 1435, Bianco 1436, Pareto 1455, Roselli 1468, Benincasa 1482, and the anonymous Weimar map probably by Freducci and dating somewhere after 1481. Of these the most complete as well as the earliest is Beccario's¹³ (Fig. 3). He gives the islands the collective title of "Insulle a novo rep'te" (newly reported islands), which may refer to the discovery recorded by Behaim for 1414 or to some more recent experience. The interval would not be much greater than that between the first landing of Columbus and the narrative of Peter Martyr beginning with equivalent words. It is likely, however, that some lost map or maps preceded Beccario's, for the artificially regular outlines of his islands, though in accord with the fashion of cartography in his time, seem rather out of keeping with a first appearance. The type had somehow fixed itself with curious minuteness and was repeated faithfully by his successors. In spite of these impossibly symmetrical details and some discrepancies as to individual direction of elongation and latitude, the fact remains that in the Atlantic there is no such great group except the Antilles and that the general correspondence is too surprising to be explained by mere accident or conjecture. Surely some mariner had visited Cuba and some of its neighbors before 1435.

This map of Beccario had been somewhat neglected, with misreading of the names, before it was taken carefully in hand by the Italian Geographical Society and reproduced very carefully, the island names in particular being accurately read and given. This eliminated some misunderstanding and confusion and made their meaning plain. Thus rendered, the map affords a convenient standard for the others, which, indeed, differ from it very little as to these "Islands of Antillia."

THE FOUR ISLANDS OF THE ANTILLES ON THE BECCARIO MAP

This group, or more properly series—for three of them are strung out in a line—comprises the four islands Antillia, Reylla, Salvagio, and I in Mar. All these names have meaning, easy to render.

¹³ Gustavo Uzielli: *Mappamondi, carte nautiche e portolani del medioevo e dei secoli delle grandi scoperte marittime costruiti da italiani o trovati nelle biblioteche d'Italia*. Part II (pp 280-390) of "Studi Bibliografici e Biografici sulla Storia della Geografia in Italia," published on the occasion of the Second International Geographical Congress, Paris, 1875, by the Società Geografica Italiana, Rome, 1875; reference on Pl. 8 (the second edition, Rome, 1882, does not contain the plates).



ANTILLIA

The largest and most southerly, Antillia, the "opposite island," which I take to be no other than Cuba, is shown as an elongated, very much conventionalized parallelogram, extending from the latitude of Morocco a little below the Strait of Gibraltar to that of the upper part of Portugal. As Humboldt says, it is about a third as wide as it is long; and in this respect it is singularly even throughout its length. In its eastern front there are four bays, and three in its western. The intervals on each side are pretty nearly equal, and each bay is of a three-lobed form resembling an ill-divided clover leaf. In the lower end there is a broader and larger bay nearly triangular. The artificial exactness of these minute details is in keeping with the treatment on divers maps of the really well-known islands of the eastern Atlantic archipelagoes, except that the comparative smallness of a Teneriffe, a Terceira, or even a Madeira, offered less opportunity. The slant of the island is very slightly east of north, obviously quite different from the actual longitudinal direction of the even more elongated Queen of the Antilles.

REYLLA

Behind the lower part of Antillia, much as Jamaica is beyond the eastern or lower part of Cuba, and about in similar proportions of relative area, Beccario shows a smaller but, nevertheless, considerable island, pentagonal in outline, mainly square in body, with a low westward-pointing broad-based triangular extension. He gives it the impressive name of Reylla, King Island, not ill suited to the royal beauty of that mountainous gem of the seas.

SALVAGIO

North of Antillia and nearly in line with it, but at a rather wide interval, he shows Saluagio or Salvagio ("u" and "v" being equivalent), which has the same name then long given to a wild and rocky cluster of islets between Madeira and the Canaries, that still bears it in the form Salvages. Wherever applied the name is bound to denote some form of savageness; perhaps "Savage Island" is an adequate rendering, the second word being understood. This Salvagio imitates the general form of Antillia on a reduced scale, being, nevertheless, much larger than any other island in the Atlantic south of the parallel of Ireland. Like Antillia, its eastern and western faces are provided with highly artificial bays, three in each. Its northern end is beveled upward and westward. I think this large island probably represents Florida, similarly situated to the northward of Cuba and divided from it by Florida Strait. Its area must have been nakedly conjectural, as much later maps show its line of supposed severance from the mainland to have been drawn by guesswork.

I IN MAR

The inclined northern end of Salvagio is divided by a narrow sea belt from I in Mar, which has approximately a crescent form and a bulk not very different from that commonly ascribed at that time to Madeira. "I," of course, stands for *Insula* or one of its derivatives, such as *Illa*, a word or initial applied or omitted at will. "Island in the Sea" is probably the true rendering, though formerly the initial and the two words were sometimes blended, as *Tanmar* or *Danmar*, to the confusion of geographers. A larger member of the Bahama group lying near the Florida coast would seem to fill the requirements, being naturally recognized as more at sea than Florida or Cuba. Great Abaco and Great Bahama are nearly contiguous and, considered together, would give nearly the required size and form; but it is not necessary to be individual in identification. Possibly *Insula in Mar* as drawn was meant to be symbolical and representative of the sea islands generally rather than to set forth any particular one of them.

THE ROSELLI MAP OF 1468

The Roselli map of 1468,¹⁴ the property of the Hispanic Society of America, New York City, is nearly as complete as the Beccario map of 1435. It lacks only the western part of *Reylla* (a name here corrupted into "roella"), by the reason of the limitations of the material. These maps were generally drawn on parchment made of lambskin with the narrow neck of the skin presented toward the west, perhaps as the quarter in which unavoidable omissions were thought to do the least harm. I do not make out this island very clearly on the map which illustrates Dr. Stevenson's work on portolan charts, but it is quite unmistakable on the enlargement which he has supplied me from the negative, though the lines are faint and in a few decades of exposure of the original might have vanished altogether. This raises the question whether certain outlines, now missing but plainly called for, on other maps of the same period, have not met with the same fate. Probably this has happened. *Antilia*—spelled thus—is plain in name and outline; so is the island next above it, spelled *Saluaega*. The "I" is omitted from *I in Mar*, as was often done in like cases, and the words "in Mar" are uncertain, but seem as above. The island figure is correctly given by Beccario's standard, and in general the representation of the island series is almost exactly the same. Perhaps the most discernible difference is a very slight northwestern trend given to *Antillia*, instead of the equally slight northeastern inclination in Beccario's case.

THE BIANCO MAP OF 1436

The Bianco map of 1436¹⁵ was the first of the *Antillia* maps to attract attention in quite modern times but has suffered far worse than Roselli's

¹⁴ E. L. Stevenson: *Facsimiles of Portolan Charts Belonging to the Hispanic Society of America*, *Publ. of the Hispanic Soc. of Amer. No. 104*, New York, 1916 Pl. 2.

¹⁵ A. E. Nordenskiöld: *Periplus*, Pl. 20. Cf. also Kretschmer, *op. cit.*, Pl. 4, map 2.

in the matter of limitation. The border of the material cuts off all but Antillia (given in full except a part of the first letter) and the lower end of Salvagio, to which Bianco has given the strange name of La Man or Mao) de Satanaxio, generally translated "The Hand of Satan" but believed by Nordenskiöld to be rather a corruption of a saint's name, perhaps that of St. Anastasio. It remains a mystery, though one hypothesis connects it with a grisly Far Eastern tale of a demon hand. The initial 'S' is all that Satanaxio has in common with the names for this island on the other maps that show it; and, as nearly all of these show very slight changes from Salvagio, easily to be accounted for by carelessness or errors in copying, the latter name is fairly to be regarded as the legitimate one, while Satanaxio remains unique and grimly fanciful, perhaps to be explained another day. The most that can be said for its generally accepted meaning is that it corroborates Salvagio in so far as it intensifies savagery to diabolism. One is tempted to speculate as to whether any very cruel treatment from the natives had formed part of the experience of the visitors along that shore; but there is no known fact or assertion upon which to base such an idea. As to the delineation of the islands, it is quite evident that Bianco showed the same group as Beccario and Roselli so far as circumstances permitted; and there is no reason to believe that the islands for which he had no room would have differed from theirs in his showing, if admissible, any more than his Antillia differs; that is to say, hardly at all.

Humboldt was so impressed by this map of Bianco that he was at the pains of measuring upon it the distance of Antillia from Portugal, making this about two hundred and forty leagues: an unreliable test, one would say, for the distances over the western waste of waters probably were not drawn to scale nor supposed to approach exactness. For that matter, the interval between Portugal and the Azores, as shown on maps for nearly a hundred years, was greatly underestimated, and the discrepancy becomes more glaring as the islands lie farther westward, Flores and Corvo being conspicuous examples. We should naturally expect to find the West Indies reported much nearer than they really are by anyone mapping a record of them. Perhaps the explanation lies in a disposition of cartographers to expect and allow for a great deal of nautical exaggeration in the mariners' yarns that reached them. A careful man might come at last to believe in the existence of an island but doubt if it were really so very far away.

THE PARETO MAP OF 1455

Pareto, 1455, has a very interesting and elaborate map¹⁶ (Fig. 4) showing Antillia, Reylla, and I in Mar (the latter without name) in the orthodox size, shape, and position, but with a great gap between Antillia and I in Mar where Salvagio should be. Very likely it was there once. Perhaps

¹⁶ Kretschmer, Pl. 5.

THE BENINCASA MAP OF 1482

Benincasa's map of 1482¹⁷ (Fig. 5) presents Salvagio as Saluaga and I in far without name but omits Reylla, both name and figure. The islands

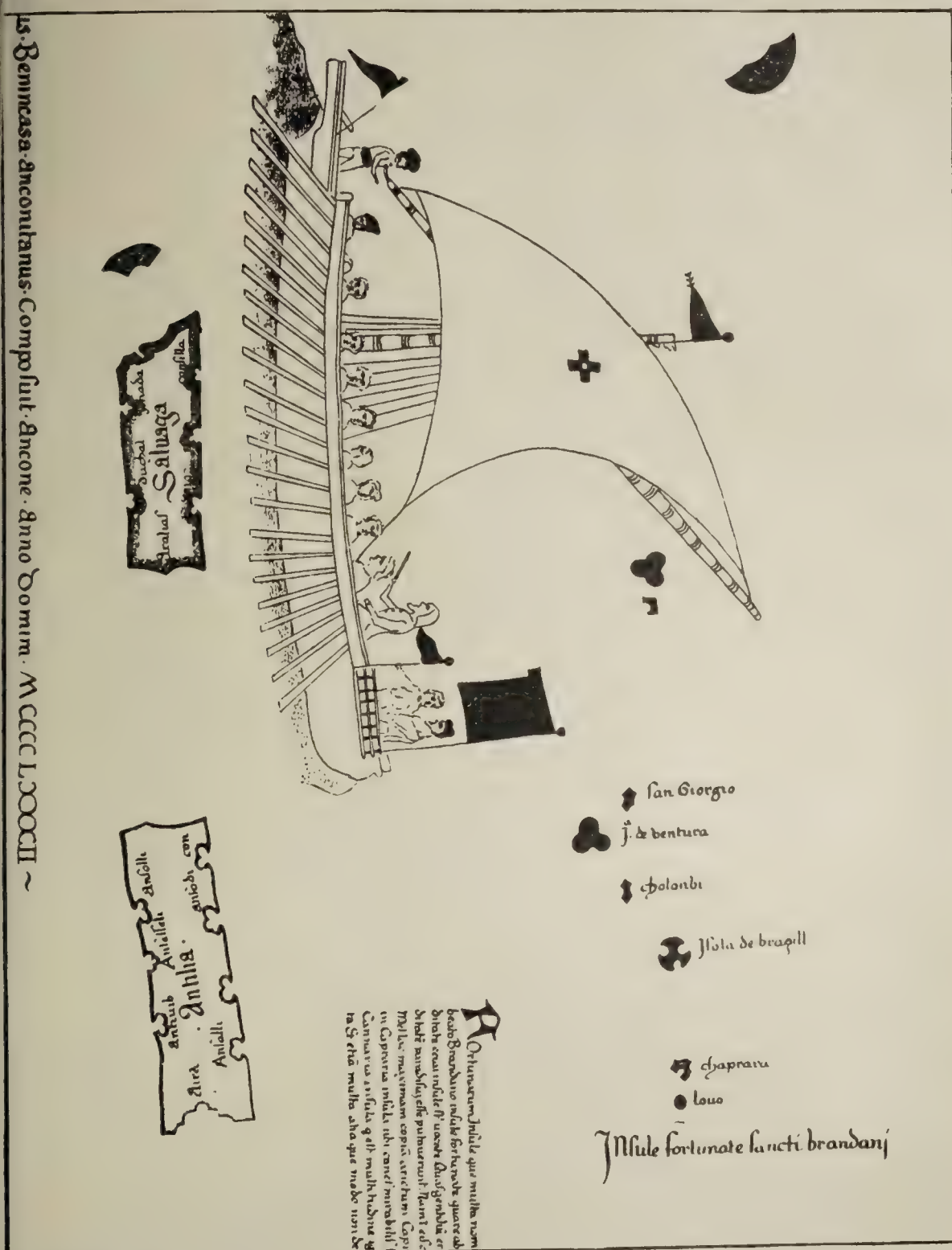


FIG. 5—Section of Benincasa map of 1482 showing Antillia and the other western islands. (Reproduced from Pl. 4 of source cited in footnote 5.)

shown are in their accepted form and arrangement, except that Saluaga has but two bays on the western side, and his map adds a novelty in a series of

names applied to the several bays, or the regions adjoining them, of the two larger islands. These names are twelve in number and seem like the fanciful work of some Portuguese who was haunted by a few Arabic sounds in addition to those of his native tongue. Several of them, like Antillia, begin with "An," perhaps another illustration of the law of the line of least resistance. I cannot think that there is any significance in these bits of antiquated ingenuity, though some have believed they found in them a relic of the Seven Cities legend.

THE WEIMAR MAP (AFTER 1481)

The Weimar map,¹⁸ though long carefully housed, has suffered blurring and fading with some other damage in its earlier history. It is evidently a late representative of the tradition and begins to wander slightly from the accepted standard. It has been curtailed also from the beginning, like Bianco's map of 1436, by the limitations of the border, which in this instance cuts off the lower part of Antillia, though the name is nearly intact; but enough remains to indicate a reduced relative size and a greater slant to the northeastward than in Beccario's map. There is, of course, no room for Reylla, and there is none for I in Mar; but Salvagio is given plainly and fully, with the letter S quite conspicuous. I cannot read more of the name on the photograph; but the Weimar librarian reads San on the original but is uncertain as to the rest. This map bears traces of local names arranged in places like those of Benincasa but fragmentary and illegible. Perhaps these names tend to show that the maps belong not only to the same period, but to the same general school of development. The other differences between this map and its predecessors are trivial. The general idea of the island series is the same so far as it is disclosed, and it is hardly to be doubted that all elements of the islands of Antillia would have been presented in the main on this map as they are by Roselli and Beccario, if there had been room to do so.

THE LAON GLOBE OF 1493

The Laon globe,¹⁹ 1493, though mainly older, certainly had room enough, but it appears to have formed part of some mechanism and to have had only a secondary or incidental, and in part rather careless, application to geography. It shows two elongated islands, Antela and Salirosa, undoubtedly meant for Antillia and Salvagio. Perhaps the globe maker had at command only a somewhat defaced specimen of a map like Bianco's or that of Weimar, showing perforce only two islands, and merely copied them, guessing at the dim names and outlines, without thinking or caring whether anything more were implied or making any farther search. This is

¹⁸ See footnotes 11 and 12.

¹⁹ A. E. Nordenskiöld: *Facsimile-Atlas*, p. 73, map in text.

apparently the last instance in which the larger two islands of the old group or series, marked by their traditional names or what are meant for such, appear together.

OTHER MAPS

It may seem strange that certain other notable maps, for example Giraldi 1426, Valsequa 1439, and Fra Mauro 1459, show nothing of Antillia and its neighbors. Perhaps the makers were not interested in these far western parts of the ocean, or the narratives on which Beccario and the rest based their maps had not reached them; more likely they were skeptical and unwilling to commit themselves.

It is also true that the Antillia of these maps is made to extend nearly north and south instead of east and west; that I in Mar is placed north of its greater neighbor instead of east; and that the whole chain of islands is moved into considerably more northern latitudes than the group which we suppose them to represent. Thus the eastern, or lower, end of Cuba is actually in the latitude of the lower part of the Sahara, and a point above the upper end of Florida would be in the latitude of the upper part of Morocco; whereas in the maps discussed the average location of the chain from the lower end of Antillia to the most northerly island, I in Mar, would run from the latitude of northern Morocco to that of southern France. There are slight individual differences in this matter of extension, but I believe Antillia always begins below Gibraltar and ends above northern Spain and a little below Bordeaux. But some dislocation, of course, is to be looked for in mapping exploration in an unscientific period. The changes of direction and extension are not greater than in the American coast line of Juan de la Cosa's very important map of 1500, not to mention even more extravagant instances of later date; and the shifting of latitudes may partly be accounted for by ignorance of the southward dip of the isothermal lines in crossing the Atlantic westward. Thus a Portuguese sailor on reaching a far western island or shore having what seemed to him the climate and conditions of Gascony would be likely to suppose that it was really opposite Gascony, though in fact it might be more nearly opposite the Canaries; and the same cause of error would apply all down the line. Cuba is not really directly opposite Portugal but may easily have been believed so.

IDENTITY OF ANTILLIA WITH THE ANTILLES

A more difficult question is raised by the absence of Haiti and Porto Rico from these maps, with all the more eastward Antilles. But it is possible that they may not have been visited or even seen. We can imagine an expedition that would touch Great Abaco, coast along Florida and Cuba, and visit Jamaica, returning out of sight, or with little notice, of the Haitian coast and barely passing an islet or two of the Bahamas, which,

if not sufficiently commemorated in a general way by *Insula in Mar*, might well be disregarded. A report of such an expedition, adding that Antillia was directly opposite Portugal and of about equal size, would account fairly for the map which for half a century was faithfully repeated even in details by many different hands and evidently confidently believed in.

Unless we accept this explanation, we must assume an uncanny, almost an inspired, gift of conjecture in some one who, without basis, could imagine and depict the only array of great islands in the Atlantic. Certainly the outlines of Cuba, Jamaica, Florida, and one of the Bahamas will very well bear comparison with Scandinavia or the Hebrides and the Orkneys as given on maps of equal or even later date. Some glaring errors are to be expected in such work, as notoriously occurred in the sixteenth-century treatment of Newfoundland and Labrador. Applying the same tests and canons and making the same allowances as in these cases of distortion of undoubtedly actual lands, we may be reasonably confident that the Antillia of 1435 was really, as now, the Queen of the Antilles.

ARCTIC GEOGRAPHY AND ESKIMO CULTURE: A REVIEW OF STEENSBY'S WORK*

By CLARK WISSLER
American Museum of Natural History

The Eskimo has always made a strong appeal to the imaginative European. We are first of all astonished at his apparent immunity to extreme cold and his ability to survive in an environment where only a few highly specialized plants and mammals make their home. Nor is this astonishment lessened when we learn that he survives not because of a special anatomical or physiological equipment but merely by the exercise of his mind; and, when we are made acquainted with the many ingenious tools and methods he has developed for utilizing the almost negative resources of his ice-bound land, our interest and admiration reach an intensity far above that for any other of the wilder folk. We are all eager to learn how these people made these interesting discoveries and conceived the ingenious devices recorded in books of travel and exhibited in our museums. This wide and natural interest in the economic and industrial life of the Eskimo has from time to time stimulated students of geography to take up the problem presented by this adjustment of human functions to a meager and unpromising environment, but in scarcely a single case have these attempts passed the superficial stage.

FIRST GEOGRAPHICAL TREATMENT OF THE PROBLEM

Strange to say, among all the illustrious names upon the honor roll of Arctic exploration in the territory occupied by the Eskimos not a single great geographer appears. True, all of these explorers made great concrete contributions to the science of geography, but none of them went out with the trained geographical mind that sees and develops fundamental problems in the relation of life to its environment. In other words, it so happened that a great geographer did not come in direct contact with the anthropogeographical problem of the Eskimo. All of our great explorers and the many brilliant students of Eskimo life have, however, given some attention to the subject, but it remained for a recent writer to give us the first comprehensive essay upon the anthropogeography of the Eskimo as a whole. This author is H. P. Steensby, a member of the modern Danish school of anthropologists who have made the Arctic peoples their special field. In his most recent work, the study on the origin of

* H. P. Steensby: *An Anthropogeographical Study of the Origin of the Eskimo Culture*, *Meddelelser om Grønland*, Vol. 53, pp. 39-228. Copenhagen, 1917. (This is an expansion and revision of his earlier study "Om Eskimokulturens Oprindelse: En etnografisk og antropogeografisk Studie," 219 pp., Copenhagen, 1905. See also his "Contributions to the Ethnology and Anthropogeography of the Polar Eskimos," *Meddelelser om Grønland*, Vol. 34, pp. 253-406, 1910.)

Eskimo culture here under discussion, Steensby attempts to analyze the environment and the complex economic life of the Eskimo and from the data so obtained to project the story of Eskimo evolution so that the reader can follow step by step the reactions to the Arctic environment finally resulting in Eskimo culture as we now know it. It is the purpose of the present article to outline the conclusions reached by Steensby, to present some of the essential phases of the problem as the reviewer sees it, and to record progress in Arctic anthropology. There are many points on which the reviewer must dissent from the inferences drawn by Steensby; but, as this is not a critical review, references to them will be meager.

STEENSBY'S MAIN THESIS

Steensby's main thesis can be comprehended under three propositions:

(a) Eskimo culture originated west of Hudson Bay around Coronation Gulf.

(b) It was originally an Indian hunting culture of the Barren Grounds area but became Eskimo culture by adaptation to the winter ice conditions of the Coronation Gulf coasts. The originators of this culture are called Paleo-Eskimos.

(c) The expansion of this culture into new territory—Alaska on the west and Greenland on the east—produced modified cultures, called Neo-Eskimo cultures. These originated by secondary adaptation to new conditions and by historic contact with other cultures.

The author claims to have reached these conclusions by the application of geographical principles. It is profitless to quarrel over a matter of definition, but what the author does is to analyze the economic culture of the Eskimo and thus show how fully he has adapted his habits to the environment. Then he works out the seasonal activities of the Eskimo, showing what occupations are followed at each natural division of the year. Finally, having these facts for each of the recognized divisions of the Eskimos—Baffin Island, Labrador, Polar (Smith Sound), Greenland south of Melville Bay, Melville Peninsula, Kinipetu (Chesterfield Inlet), Netchillik (Back River), Coronation Gulf, Mackenzie River, Point Barrow, Asiatic, Bering Strait, Yukon, Kodiak Island, and Aleutian—he compares and contrasts them and thus develops an argument for the three conclusions just stated. This may be a true geographical method, but it is the same as that used by the American anthropological school when treating problems of culture and spoken of by them as a historical method, to distinguish it from biological methods. Steensby, however, considers his chief method to lie in identifying the fundamental traits in Eskimo economic culture (material culture) and then seeking the spot where the geographically assumed natural conditions for the development of such traits exist. This is the sense in which the method is geographical, but this is the final touch, as it were, to the accepted historical method.

At the outset we should understand that Steensby treats of Eskimo culture only and not of Eskimo languages or blood. As to the origin of these characters he gives not the slightest consideration, explicitly stating that he regards them as bearing no relation to the problem involved. What he means to say is, that, assuming his second proposition to be true, the language and blood of the Eskimo are such as the first pre-Eskimo group happened to bring with them from the Barren Grounds. Presumably, had his first group spoken Algonkian, that language would still prevail in the Arctic. While this principle may be a sound one, there is a certain difficulty in trying to ignore the questions of language and blood, as we shall see later.

ORIGINAL SEAT OF ESKIMO CULTURE

Let us turn now to Steensby's first proposition, that the origin of Eskimo culture is to be sought around Coronation Gulf. The place of origin for Eskimo culture has been a favorite topic since the days of Cranz and Rink.¹ In the main, but two views have been entertained, one that the pristine home of this culture was the margin of Bering Sea, the other that its point of origin was between Coronation Gulf and the entrance to Hudson Bay. Among the supporters of the former are Cranz, Rink, and Thalbitzer; of the latter, Murdoch, Brinton, and Boas. Steensby reviews the discussions of these writers at length, finally taking his stand with Murdoch, Brinton, and Boas, though he locates the point of origin on the shores of Coronation Gulf, to the exclusion of Hudson Bay. The one fact upon which all of the aforementioned authorities are agreed is that the most typical Eskimo culture occurs around Coronation Gulf. Students of culture always find that the more primitive cultures are distributed after one characteristic pattern, namely, a nucleus around which lie marginal varieties. Of these the nucleus is always the purest in type, while the more marginal forms are mixed with new elements, or, if isolated, composed of the most primitive forms. Those who regard Coronation Gulf as the cradleland of Eskimo culture seem to base their conclusion on the theory that a culture's place of origin lies in the nucleus. Steensby, however, presents a detailed analysis of the case to show that the concrete evidence for the specific case of Eskimo culture is very strong. On the other hand, his able and learned contemporary, Thalbitzer, makes a strong case for a Bering Sea origin, regarding the cultures at Coronation Gulf as approximately the old type developed around Bering Sea, with the addition of later intrusive traits from Alaska—the result being a modern less typical form. It is doubtful if either of these propositions can be absolutely

¹ David Cranz: *Historie von Grönland, enthaltend die Beschreibung des Landes und der Einwohner, etc., insbesondere die Geschichte der dortigen Mission der evangelischen Brüder zu Neu-Herrnhut und Lichtenfels*, 2 vols., Barby and Leipzig, 1765. The English edition reads: David Crantz: *The History of Greenland, Containing a Description of the Country and Its Inhabitants*, 2 vols., London, 1767.

H. Rink: *The Eskimo Tribes: Their Distribution and Characteristics, Especially as Regards Language, with a Comparative Vocabulary and a Map, Meddelelser om Grønland*, Vol. 11, Copenhagen, 1887-91.

proved until extensive archeological investigations have been made, for as yet we have no chronology for Eskimo culture. Until we are able to localize and map the successive distributions of Eskimo culture traits, either of these theories has plausibility. This is clearly recognized by Steensby, but he contends that the weight of geographical evidence favors a central origin. In this we agree.

THE ESKIMOS ORIGINALLY AN INLAND PEOPLE?

The author's second proposition assumes that the original Eskimos were an inland people. Rink long ago propounded a similar view, except that he chose the Yukon delta as the place where the transition from the one character to the other was made. Steensby selects the Barren Grounds, as stated. Let us first consider the more general argument for an inland origin of Eskimo cultures and leave the specific location of the transition till later. To this end we must review the chief facts to be considered.

The habitat of the Eskimos in historic time comprises the immediate coast belt of Arctic America and the adjacent coast of Siberia. During the last century they seem to have numbered less than 40,000, and it is doubtful if they were ever more numerous. So sparse a population could not have occupied the entire coast simultaneously, but by necessity the Eskimos distributed themselves in tiny groups, often many miles apart. As we shall see later, the homes of these groups could rarely remain fixed but must be frequently shifted. In this manner it came about that the entire Arctic area was at one time or another occupied by Eskimos. Our first problem, then, is to understand the nature of the entire coast. Steensby regards the coast as comprising three great domains, Greenland, the Arctic Archipelago, and the western coast. On the whole, the last is made up of late geological formations and lies open toward the sea, with the result that it has a regular coast line and few islands. On the other hand, the region of the Archipelago, especially along the southern and eastern borders of the islands, is made up of old granitic rock and accordingly has abrupt coast lines and rocky inlets. Yet the northern and less explored parts of these islands seem to be a later formation and so to have become more regular. Greenland, again, is essentially granitic. The details of these coast lines, the prevailing winds, and the orientation of the inlets determine the ice conditions, which in turn affect the winter fauna, as we shall see.

THE MUSK-OX AS A BASIS OF ESKIMO CULTURE

The fauna of the Arctic is peculiar in that mammals are found at the seashore as well as upon the land. Of the seashore mammals the seals are the most important to the Eskimo. On land the caribou (American reindeer) and the musk-ox take the first rank. To comprehend quickly this phase of the problem we may remind ourselves that three genera of land mammals ranged over the northern and central portions of North America

—the bison in the south, the musk-ox in the far north, and the caribou between. Around the bison developed a prehistoric hunting culture, that of the Plains Indian. In like manner, the caribou of the Canadian northland supported a culture peculiar to that area, the Cree and Déné (Athapascan). Steensby's thesis is, in part, that the typical Eskimo culture is based upon the musk-ox. The accompanying map (Fig. 1²) gives one a general idea of the distributions of the caribou and the musk-ox. They are not mutually exclusive, for the caribou are found in the musk-ox country as well. Yet, if we are correctly informed, the grazing habits of the two are different to a degree that results in their segregation to widely separated ranges. It would thus be impracticable to hunt both; and, since the season for both is the same, summer and autumn, a given group of Eskimos could not well depend upon both the musk-ox and the caribou but must needs specialize upon one or the other. As the map shows, however, the caribou has a far wider distribution than the musk-ox; hence it is not strange that in historic time the Eskimos of Alaska, those of the northern Canadian coast, and those around Hudson Bay and eastward, came to depend upon the summer hunting of caribou for their winter clothing and reserve stores of meat. Indeed, they are so dependent upon this animal that the threatened destruction of the caribou is looked upon as the death knell of the Eskimo.

Steensby's idea is that the Eskimos find the musk-ox easier to kill than the caribou, prefer his flesh and fat, and so turn to that animal wherever it is available. This is one of his main theories; but to understand the use he makes of it in his view of Eskimo culture we must turn to the mammals of the seacoast.

TYPICAL ESKIMO CULTURE DETERMINED BY CONDITIONS OF WINTER SEALING

Everyone knows that the common seals are the chief support of the Eskimos in winter. During that season they are taken through the ice at their breathing holes. Now, since the Eskimos are almost solely dependent upon the seal in winter, the conditions determining the distribution and number of seals will in turn affect the distribution and numerical strength of the Eskimos. The chief physical factor in this complex is the shore ice.

. . . But in the Arctic region the sea is a very different element from the undulating billows of milder zones. Only during a couple of months in the summer and in the most favorable areas is it sea in the ordinary sense of the word. The greater part of the year it is ice-covered and solid; but even this is not all, because only in a few places is the sea allowed to freeze smoothly as a lake does with us. Wind and current frequently drive masses of loose blocks of ice or pack ice in towards the coast, whereby the newly formed ice is broken up and the surface of the sea becomes rough and impassable when the blocks freeze together in a coherent conglomeration. Only in the most protected, remote straits and among the skerries are formed the smooth ice surfaces which are called winter ice in contradistinction to pack ice, which may consist of blocks

² Sources: (1) Map showing distribution of woodland and Barren Ground caribou in North America, with type localities of species, following p. 196 in Madison Grant: *The Caribou*, 7th Annual Rept. New York Zool. Soc., 1902, pp. 175-196; (2) map in work cited in footnote to title, *Meddelelser om Grønland*, Vol. 34, p. 401.

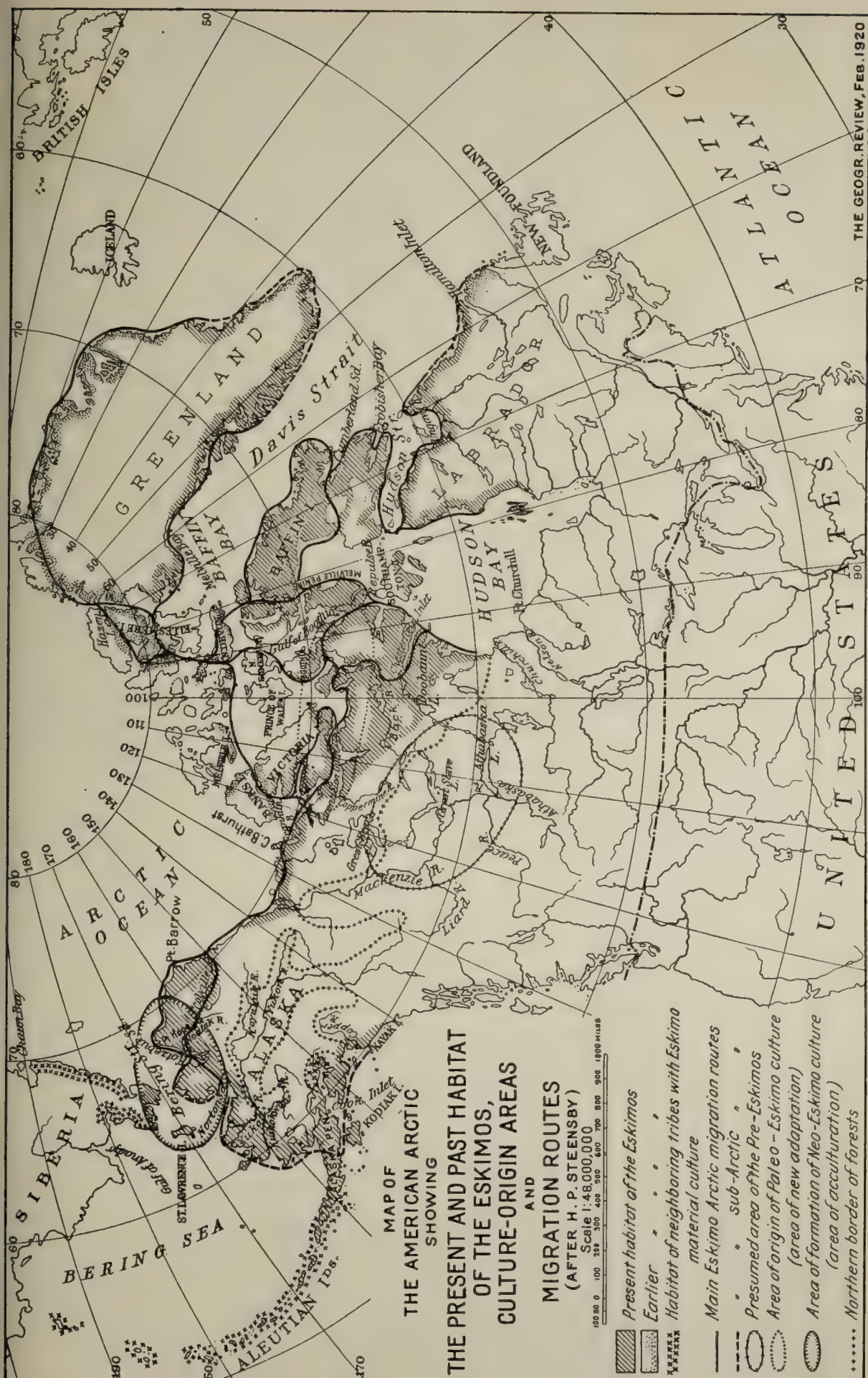


FIG. 2

several years old. With the winter ice, which breaks up every year, must not be confounded the, in places, perennial ice foot which in many places follows the coast and forms a smooth and safe path for traveling by sledge.³

The "winter ice" is the relatively smooth ice that covers a protected inlet, and it is under this that the seals live. Sealing grounds are, then, determined by the configuration of the coast, the prevailing winds, etc. The present habitat of the Eskimos as shown on the second map accompanying this article (Fig. 2⁴) is in the main an index to the winter distribution of the seal. Steensby quotes Boas as follows:

Besides the configuration of the land, the extent of the land ice formed during the winter is of vital importance to the inhabitants of the Arctic region, because during the greater part of the year it affords the only means of communication between the tribes, and because in winter the seal, which constitutes the principal food of the Eskimo, takes to those parts of the coast where extensive floes are formed. Therefore the state of the ice regulates the distribution of the natives during the greater part of the year and must be considered in studying the habits of the Eskimo. The extent of the land ice principally depends on the configuration of the land and the strength of the currents. On a shore exposed to a strong current an extensive floe can only be formed where projecting points of land form deep bays. We find the distribution of ice regulated in accordance with this fact all around the shores of the Arctic Ocean.⁵

A large part of Steensby's discussion is for the purpose of proving that the parts of the coast not visited by Eskimos in winter have unfavorable ice conditions and that the typical Eskimo culture is found only where the ice is most favorable to winter sealing. This condition is met best in the region adjacent to Coronation Gulf, and for this reason Steensby claims strong support for his view that Eskimo culture could have originated nowhere else.

We may quote our author's table⁶ showing the seasonal cycle of the typical Eskimo culture:

TABLE I—SEASONAL CYCLE OF TYPICAL ESKIMO ACTIVITIES

SEASON	PLACE OF ABODE	OCCUPATION	PRINCIPAL IMPLEMENTS	DWELLING
Winter....	In the beginning of the winter, the coast land. Later in the winter, the sea ice	Hunting on the sea ice	Dog sledge; harpoon	In the beginning of the winter, earth house. Later in the winter, snow house
Summer..	Inland	Hunting on land and fishing in rivers	Kayak; lance; bow and arrow; salmon spear	Tent

The notion seems to be that in summer the Eskimo reverts to his original culture by proceeding inland to hunt land mammals, but that in winter he returns to the ice and lives upon seals. The whole point of view is well

³ Steensby, p. 65.

⁴ Source: Map of the Eskimo Territory and Adjacent Regions, in work under discussion, *Meddelelser om Grønland*, Vol. 53, plate.

⁵ Steensby, pp. 70-71, from Franz Boas: *The Central Eskimo*, *Sixth Annual Rept. of the Bureau of Ethnol.*, 1884-85, Washington, D. C., 1888, pp. 399-669; reference on p. 417.

⁶ P. 157.

presented in the concluding pages of one section of Steensby's work which are given here in full, with slight modifications of style:⁷

CONCLUSIONS REGARDING THE ARCTIC AND SUB-ARCTIC FORMS OF CULTURE

..... The Central Arctic group [of Eskimo hunting methods and of the implements the Eskimos use in connection with their economic life] must represent the oldest Eskimo culture, as will also be seen from the following arguments:

(1) The reason why the so-called second group, or certain sub-Arctic implements and methods, do not occur in the central regions is purely geographical, as shown above.

(2) Moreover, it has been shown that the most typical sub-Arctic forms are easily explained either as borrowed later from outside sources (for example the *umiak*) or—like the hunting *kayak*—as special products of Arctic Eskimo implements developed by adaptation to sub-Arctic surroundings, and, probably, stimulated by adoption of elements from outside.

(3) Among the Central Arctic Eskimos, on the other hand, one meets with all the methods and implements which are peculiar to Eskimo culture (that is, those not found in other cultures), and they are met with in their most primitive form and usage, while among the western and eastern sub-Arctic Eskimos they either do not occur (methods of hunting on the ice, the snow house, etc.) or else they have been developed to a special degree (the finest instance of which, again, is the development of the hunting *kayak* from the river *kayak*).

(4) A further argument for the transition from Arctic to sub-Arctic Eskimo culture is that such a transition must as a matter of fact have taken place from the Arctic Archipelago and Arctic northern Greenland to southern sub-Arctic Greenland and from the Arctic Archipelago to Labrador. Consequently, as the transition from Arctic to sub-Arctic culture can take place, and has taken place, in an easterly direction, our supposition that it has also happened along the western line of distribution of Eskimo culture from the Archipelago to Alaska is strengthened.

Therefore, from the above arguments, we are forced to conclude that *Eskimo culture is oldest in its Arctic form*.

The sub-Arctic Eskimo culture, on the other hand, must be regarded as a form derived from the Arctic Eskimo culture which has been brought about partly by new adaptations, when the Eskimos emigrated down into the sub-Arctic regions, and partly by the influence and stimulus exerted by the cultures with which they there (especially in the districts around Bering Strait) came into contact.

This transition from Arctic to sub-Arctic Eskimo culture is, anthropogeographically, easily accounted for, while a development in the opposite direction from sub-Arctic to Arctic would be rather difficult to conceive, there being in the sub-Arctic culture an entire absence of any rudiments from which some of the chief elements in the Arctic winter culture could spring. Consequently, in the latter case there could be no other explanation than this, that they were cultural borrowings; but no other form of culture is known from which the most typical Arctic cultural objects and methods of hunting could conceivably have been borrowed.

This negative consideration is also an argument in favor of the Arctic form of culture being the original one.

THE HOME OF ESKIMO CULTURE FROM AN ANTHROPOGEOGRAPHICAL POINT OF VIEW

The home of Eskimo culture is consequently synonymous with the home, or point of origin, of Arctic Eskimo culture.

The point of origin must have been an area in which there were the necessary

⁷ Pp. 166-170.

geographical conditions for the existence of the Arctic Eskimo culture. Indeed, very special conditions must have been present in this area for it to have forced the ancient Eskimos, through the demands of adaptation, to modify their original culture in an "Eskimoic" direction.

Even according to this view there can scarcely be any question of other tracts than such as are still inhabited by Eskimos. The northern coast of Siberia is excluded by its geographical nature. Its decidedly flat-shore character with low-water areas of great extent and its barrier-forming masses of pack ice and lack of extensive fields of winter ice over deep water behind protective groups of islands, all have prevented Eskimo culture from being able to find, on the whole, means of distribution there.

Then there is the northern coast of America. But even that is too large to be taken, as a whole, for the point of origin. For instance, we must leave out the stretch of coast along Alaska's northwestern and northern coasts, from Kotzebue Sound towards the Mackenzie, because, for similar reasons as hold for the northern coast of Asia, it is not inviting for the Eskimos, and only at places, few and far between, from Kotzebue Sound to Point Barrow are small groups of Eskimos met with, and they are mainly dependent on whale hunting—thus borrowing from more southerly regions their manner of obtaining a livelihood.

We next come to the stretch of coast on both sides of the mouth and the delta of the Mackenzie. This place, where a large river abounding in fish connects the inland regions with the sea, might appear to be well suited to participate in the development of Eskimo culture. But, nevertheless, I do not think that this has been the case. First, the district with its abundance of fresh water in the delta and with its abundance of driftwood could permit of what we may term an "Indian" mode of life; it is impossible to believe that the district in question could force people having another mode of life to make radical and fundamental changes in it. Second, these Eskimos at the mouth of the Mackenzie did not in any great degree use the abundant driftwood for fuel in winter but depended upon oil lamps, which shows that their ancestors had migrated from regions where driftwood was not abundant. It must, then, be assumed that the Mackenzie Eskimos have migrated along the coast from Coronation Gulf or adjacent parts.

Then we have left only the Barren Grounds peninsula, between the Arctic Ocean and Hudson Bay, and the Arctic Archipelago situated in front of the Arctic Ocean. As regards the regions more easterly than Hudson Bay, these are out of the question for both geographical and ethnographical reasons.

These considerations lead us to the region of the Arctic Archipelago, where we find the Arctic economic culture in its most typical form. Hence it appears that we must also assume that *the Arctic Archipelago is the region where Eskimo culture originated.*

We must suppose, then, that for some reason or other the ancient Eskimos moved across the inland regions between Hudson Bay and the lower Mackenzie River to the coast of the Arctic Ocean and the southern parts of the Archipelago, by which Coronation Gulf and the Netchillik [Back River] districts are especially meant; and that Eskimo culture was gradually modified as an adaptation to the peculiar natural conditions existing in the Archipelago. Of these natural conditions the most important features to be mentioned are the ice covering, the aquatic mammals, the wanderings of the reindeer herds, and the absence of wood. To these must be added, in connection with the times we are here considering, the musk-ox; originally it must have been of great importance.

It is these natural conditions in the Archipelago—or, to put it more exactly, in the coast and sea regions between the mainland and the islands—which were able to force a slow, hunting people such as the ancient Eskimos must have been to undertake so thorough a cultural change as that which the modification of the Eskimo culture must have required.

FROM CONTINENTAL CULTURE TO COAST CULTURE

The Eskimos are always described as a coast people and their culture as a well-marked coast culture. This is of course true as regards the sub-Arctic Eskimos; but, properly speaking, it does not in reality apply to the Arctic Eskimos.

It is true that, in a strictly geographical sense, the Arctic Eskimos are inhabitants of the coast. But in reality their culture is not adapted to a coast life in the general meaning of the term. This is at once seen by looking at the table for the summer and winter cultures of the decidedly Arctic Eskimos [Table I]. Normally the summer is spent inland, and they do not move to the coast until the sea is frozen over.

The typical mode of life of the Arctic Eskimos consists, then, in moving to and fro between the interior and the sea ice, while the coast and the open sea play so insignificant a rôle for them that *they must be described as quite continental in their mode of living.*⁸

This continentality is interestingly illustrated by the fact that the testaceous and crustaceous animals of the coast, which are otherwise so important as reserve food for inhabitants of the coast with a hunting culture, play no rôle whatever for the Arctic Eskimos. There is hardly any other explanation for this than that the latter descended, or at any rate inherited their mode of living and way of thinking, from inhabitants of the inland who moved directly out to the Arctic seacoast, where they developed this mode of living with its continental characteristics. As regards the observation mentioned above, I may cite Stefansson: "No sort of shellfish seems ever to have been used as food by the Eskimo, north of the mouth of the Yukon River at least, although clams and shrimp abound in certain places, and their use is just now being introduced by white men."⁹

It is clear, then, that Eskimo culture in its older, original form—the Arctic form—has still preserved its continental character. The modification of Eskimo culture into a real coast culture takes place only gradually, as it gets away from the Arctic Archipelago and becomes sub-Arctic.

A PALEO-ESKIMO AND A NEO-ESKIMO LAYER OF CULTURE

Herewith we finish the anthropogeographical investigation, in which we have studied the economic culture of the various Eskimo groups as it has developed in various places on the basis of geographical adaptation.

It appears, however, that Eskimo culture ought not to be regarded exclusively as a result of geographical adaptation. Influence and borrowings from without have also conduced to the formation of the Eskimo culture which we now know, or which, more correctly, defined itself when the Europeans first established a connection with the different divisions of the Eskimos. Yet adaptation is the primary factor—influence from without being a secondary factor in the development.

We have arrived at the conclusion that *Eskimo culture* is oldest in its Arctic form and that it *has arisen in the Arctic Archipelago as a product of adaptation.*

From the Archipelago the Arctic Eskimo culture spread east and west as far as the ice conditions allowed. Towards the west it reached the districts at Bering Strait, where it came under foreign influence, especially under the so-called Pacific-Asiatic influence. By this we understand influence along the coast route from various Asiatic-Pacific peoples. The conception must be understood collectively, because there is so much that is unknown and unraveled as regards the ethnology and history of these peoples; but there can hardly be any doubt that it is in this direction we must search for the most important source of cultural influence on the Eskimos before they met the Europeans.

⁸ Cf. work cited in footnote to title, *Meddelelser om Grønland*, Vol. 34, p. 402.

⁹ Vilhjalmur Stefansson: *The Distribution of Human and Animal Life in Western Arctic America*, *Geogr. Journ.*, Vol. 41, 1913, pp. 449-460; reference on pp. 450-451.

It so happened that the foreign influence was not so much a re-fashioning of the Eskimo culture created in the Archipelago as a contribution toward a further development in established directions. Some new implements were, of course, adopted; but the fact that contact with a higher and richer technique no doubt brought about improvements of existing forms is of just as much significance. Thus not only was the Arctic form of Eskimo culture improved, but simultaneously Eskimo culture expanded and advanced farther in a southern direction, whereby the sub-Arctic form was first fashioned and developed.

The place of this influence, or rather of these various influences, among which the so-called Pacific-Asiatic is the most important, was the western coast of Alaska or the districts around Bering Strait, which we can best express by alluding to the most essentially geographic moment, namely, the nearness to Asia.

With this demonstration of the Archipelago and Bering Strait as the two geographical foci in the history of the development of Eskimo culture—the Archipelago being important for adaptation and Bering Strait for influence from without—the investigation at issue practically ends. To make these results more definite other scientific methods, ethnographic, archeologic, etc., must be employed.

CRITICISM OF STEENSBY'S RESULTS

The brief summary we have now made of Steensby's study, inadequate as it is, will enable us to understand his theories as to the origin of Eskimo culture. He is not content to show that the center of origin for this culture lies around Coronation Gulf but offers us a theory as to what kind of people took the first steps necessary to the development of such a culture. As he sees the case, Eskimo culture is merely the annual life cycle of North Canadian hunters, who pursued the caribou in the Barren Grounds west of Hudson Bay until winter forced them to the shore, where they developed sealing and living upon the smooth ice. He chooses the Barren Grounds for the reason that here among the Canadian Indians we find a hunting culture quite like the summer inland life of the Eskimos. The chief weakness of this position lies in our ignorance of the part the Eskimos have played in the development of Indian culture in sub-Arctic Canada. It is quite unlikely that the proximity of two highly developed cultures like the Eskimo and the Indian and the ready mixing of blood observable in Alaska could have continued long without some decided reaction on the part of the Indian. Hence many of the similarities noted by Steensby may have resulted from Eskimo influence upon the culture of the Indian. The whole extent of the caribou range was the home of many diverse Indian tribes, yet their hunting culture centered around the caribou and was remarkably uniform throughout. This American reindeer culture is also highly characteristic of what Steensby calls the sub-Arctic Eskimo culture and is also found in the summer sector of the yearly cycle for the true Eskimo. The extreme marginal position of the Eskimos would rather suggest that they borrowed this reindeer culture from the Indians.

It is difficult to escape the conclusion that Eskimo culture is essentially a sea-mammal culture. Steensby's objection to the designation seacoast can be granted, but we cannot deny that the Eskimo specializes upon sea

mammals the greater part of the year, just as did the adjacent Indian upon the caribou. The problem is, then, largely one of chronology, for one must know which of these cultures was first upon the ground.

The idea that the musk-ox was the nucleus around which the Eskimo operated, and that the "musk-ox road" was the path that led these Paleo-Eskimos ever on toward the north, is a suggestive one. Steensby finds it easy thus to account for the appearance of Eskimo remains on the eastern side of Greenland by the old theory of migration around the northern coast of that island. In a recent article in the *Review*¹⁰ the well-known Knud Rasmussen raises strong objection to this, on the ground that it would be physically impossible for Eskimos to travel along that coast. On the other hand, the archeology of Greenland shows no traces of the ancestors of the Eastern Greenlanders except on that side of the island, and all the objects so far found connect these Eastern Greenlanders directly with the Polar Eskimos on the northwestern side of Greenland. In the face of these facts, the question must still stand as favoring such a northern migration, notwithstanding the apparent impossibility of such a movement. Primitive people, and even mammals, have done some seemingly impossible things that still defy our understanding. It would be well, however, for Danish students to make a more careful archeological examination of the Greenland coast on the west and south, since traces of an older culture may still remain to be discovered.

CONSIDERATIONS THAT MODIFY HIS CONCLUSIONS

Reverting to the general suggestions of the musk-ox road: Instead of assuming that Eskimo culture was a mere offshoot of Déné Indian culture, it would seem more logical to have assumed that the original, or Paleo-Eskimo culture, was a relatively ancient one and was essentially a musk-ox-hunting culture of the inland, as in fact the author has maintained in his earlier papers; that by necessity and geographical pressure this culture became a sea-mammal culture, supplemented by the adoption of caribou culture as practiced by the adjacent Indians; and, finally, that it represents an old form of culture initiated independently of the caribou and bison cultures. There is a certain plausibility in the musk-ox theory, since one of the distinctive Indian cultures developed around the bison and another around the caribou. The fact seems to be that the musk-ox once ranged over the entire Arctic area and gives some evidence of being the older fauna; and this would make probable the development of an Eskimo musk-ox culture.

The similarities between Eskimo caribou hunting and the hunting of the Déné tribes in Canada have also their parallel between the latter and the bison hunters of our Western plains. These resemblances are about

¹⁰ Knud Rasmussen: Migration Routes of the Eskimos in Northern Greenland, *Geogr. Rev.*, Vol. 8, 1919, pp. 180-183.

as striking as are those between the Eskimo and the Déné, and by analogy it would follow that the origin of caribou culture is to be explained by a detached group of bison hunters moving out toward the Barren Grounds, where they found caribou and developed a new culture. Then later a detached group with this new culture moved to the Arctic coast and started Eskimo culture. From what we know of culture in general it seems unnecessary to seek an explanation of the similarities between Eskimo, caribou, and bison cultures in a common origin, for the mere geographical proximity of the peoples involved would in time lead to similarities in their cultures. Yet, as Steensby has stated, the ultimate solution of this problem must await extensive archeological investigations and the establishment of a relative chronology for the cultures involved.

STEENSBY'S DISTINCTIVE CONTRIBUTION TO THE ESKIMO PROBLEM

In conclusion, the contribution of Steensby to the Eskimo problem lies in his masterly analysis of the local geographical conditions surrounding the several groups of Eskimos and his clear demonstration that many of the variations in the annual food-gathering cycles of these groups are directly correlated with these differences in geology, climate, and fauna. To our mind these are successful scientific demonstrations and as such constitute a contribution of great value. His theories as to the derivation of Eskimo culture from that of the Indian can scarcely be demonstrated. No solution of this question can ignore the anatomical and linguistic problems. While it is not denied that the body of the Eskimo has Indian resemblances, still he has highly specialized cranial characters and finds close parallels on the Siberian coast. In other words, he appears to be a later arrival than the Indian. Again, his language is distinct. Our inability to make the anatomical and linguistic affiliations of the Eskimo correlate with the supposed origin of that culture is a real objection to Steensby's theory of origin and necessitates extreme caution in proceeding with any arguments that rest upon the assumption of its validity. However, this does not in the least detract from the merit of this most recent work of the distinguished Danish student, the greater part of which deals with the relation between Eskimo culture and geographical environment.

THE ST. LOUIS MEETING OF THE ASSOCIATION OF AMERICAN GEOGRAPHERS

The fifteenth annual meeting of the Association of American Geographers was held in the Soldan High School building, St. Louis, on Tuesday, Wednesday, and Thursday, December 30, 1919, to January 1, 1920. The average attendance at the sessions was about 35, one-half of whom were members. Twenty-four papers were read in addition to the three presidential addresses which were presented at joint sessions with the National Council of Geography Teachers and Section E (Geology and Geography) of the American Association for the Advancement of Science. All three of these addresses were notable. David White's vice-presidential address on "Geology as Taught in the United States" was a remarkably forceful presentation of reasons for the decline in popular interest in geology in schools and colleges. He laid special stress on the importance of teaching geology as a branch of general culture and deplored the tendency to grade professors of geology mainly by their reputation for research and very little for their ability to inspire their students through effective teaching.

President Dryer's address on "Genetic Geography: The Development of the Geographic Sense and Concept" was scholarly to a high degree and will rank among the finest presidential addresses that have been presented before the Association. It ought to be given a much wider circulation than it will receive if its publication is confined to the Association's *Annals*.

For the first time, the president of the National Council of Geography Teachers gave a presidential address; it followed the address of President Dryer. The subject was "Geography Teaching and the War," and the paper was written and presented in the delightful style and deep undertone of human sympathy which characterize whatever Professor Brigham does. Seven of the twenty-four papers presented were by members of the newly formed American Meteorological Society (to which reference is made in the "Geographical Record" section of this number), five of them also members of the Association of American Geographers. Of the remaining seventeen papers, eight were given by non-members of the Association. Only three members from Eastern colleges were present, and the only papers offered by representatives of Government bureaus were given by officials of the Weather Bureau at the joint session with the meteorologists. Professor H. E. Gregory of Yale was elected president for the next year; Professor R. E. Dodge, secretary and editor; and R. H. Whitbeck, councilor. In his closing remarks, President Dryer expressed his belief that, in the quality of the papers presented and in the general interest of the discussions, the St. Louis meeting ranks among the best the Association has held. The extension of time for the reading and discussion of papers to thirty minutes, and in many cases to forty-five minutes, was found to be a decided advantage.

Following is the list of papers and addresses actually presented:

• General

C. R. DRYER: Genetic Geography: The Development of the Geographic Sense and Concept. (Presidential address, Association of American Geographers; joint meeting with the National Council of Geography Teachers.)

NEVIN M. FENNEMAN: Geography as a Subject of Research.

R. H. WHITBECK: "Geonomics?"

DAVID WHITE: Geology as Taught in the United States. (Vice-Presidential address; joint meeting with Section E, American Association for the Advancement of Science.)

- A. P. BRIGHAM: Geography Teaching and the War. (Presidential address, N. C. G. T.; joint meeting with the N. C. G. T.)
- WALLACE W. ATWOOD: The Educational Advantages of the Regional Treatment of Geography. (Joint session of the A. A. G. and the N. C. G. T.)
- STEPHEN S. VISHER: Use of Laws in Teaching Climatology. (Joint meeting with the American Meteorological Society.)
- J. WARREN SMITH: Motion Pictures of Weather Maps: A Report of Progress. (Joint meeting with the A. M. S.)
- F. J. WEST: Determination of Normal Temperature by a New Method. (Joint meeting with the A. M. S.)
- J. WARREN SMITH: Cultivation Does Not Increase Rainfall. (Joint meeting with the A. M. S.)

Regional

- CHARLES C. COLBY (introduced by H. H. Barrows): Commercial Divisions of the World.
- WELLINGTON D. JONES (introduced by H. H. Barrows): Geographic Regions and Their Subdivisions as Illustrated by China.
- A. P. BRIGHAM: Cape Cod and the Old Colony.
- H. J. COX: Weather Conditions in the Orchard Regions of the North Carolina Mountain Slopes. (Joint meeting with the A. M. S.)
- FRED J. BREEZE (introduced by C. R. Dryer): Southern Indiana: A Regional Study.
- R. H. WHITBECK: Geographic Influences of Lake Michigan on Its Opposite Shores.
- CARL O. SAUER (introduced by H. H. Barrows): Economic Problems of the Ozark Highlands of Missouri.
- ARTHUR G. VESTAL (introduced by H. C. Cowles): The Colorado Mountain Front: Subregions North of the Front Range.
- STEPHEN S. VISHER (introduced by C. R. Dryer): Regional Geography of Southern Wyoming.
- W. H. HAAS (introduced by H. H. Barrows): Physical Environment of the Cliff Dwellers of the Mesa Verde.
- C. J. POSEY (introduced by R. H. Whitbeck): Regional Geography of Minneapolis-St. Paul.
- WILLIAM M. TUCKER (introduced by C. R. Dryer): The Geography of Columbus, Ohio.
- OLIVER L. FASSIG (paper read by H. J. Cox): Report on the Newly Established Weather Service in the West Indies. (Joint meeting with the A. M. S.)

Reports and Memorial

- NEVIN M. FENNEMAN: Report of National Research Council Representatives.
- GEORGE J. MILLER: Report of Progress of the National Council of Geography Teachers. (Joint meeting with the N. C. G. T.)
- CHARLES F. BROOKS: How the American Meteorological Society Can Serve Geography Teachers. (Joint meeting with the A. M. S.)
- A. P. BRIGHAM: Memorial of Frederick V. Emerson.

R. H. WHITBECK

GEOGRAPHICAL RECORD

AMERICAN GEOGRAPHICAL SOCIETY

Meetings of February. A semi-monthly meeting of the American Geographical Society was held on Tuesday evening, February 10, at the Engineering Societies' Building, 29 West Thirty-ninth Street. President Greenough presided. The lecturer of the evening was Archdeacon Hudson Stuck of the Yukon; he addressed the Society on "A Winter Circuit of the Arctic Coast." The lecture described a trip made by Dr. Stuck along the northern coast of Alaska. On February 24 a monthly meeting of the Society was held. President Greenough presided. He submitted the names of 21 candidates for Fellowship, each of whom had been approved by the Council, and they were confirmed as Fellows of the Society. Thereupon Mr. Carl Lumholtz delivered an address entitled "Through Central Borneo: Two Years' Travel in the Land of the Head Hunters." The lecture dealt with Mr. Lumholtz's expedition of 1914-16, which he undertook instead of his projected journey to New Guinea, made impossible by the war, and as a continuation of his explorations in the same island during 1913 and 1914 (*Bull. Amer. Geogr. Soc.*, Vol. 45, 1913, p. 201; Vol. 46, 1914, pp. 442-443; Vol. 47, 1915, p. 960; and *Geogr. Rev.*, Vol. 2, 1916, pp. 378-379).

NORTH AMERICA

Does Cultivation Increase Rainfall? From the days of the early settlement of the Great Plains there was a more or less widespread belief that the breaking up of the soil by ploughing and the raising of crops over extended areas resulted in an increase in rainfall. The matter has been discussed from many different points of view, meteorological opinion being emphatically against the view that any change in rainfall has been, or can be, brought about by cultivation. In a recent discussion of this same subject by Professor J. Warren Smith (*Monthly Weather Rev.*, Dec. 1919, pp. 858-860) the conclusion is reached that cultivation does not increase the rainfall in the semi-arid region. There are well-defined sequences of increasing and decreasing annual rainfall amounts, but there has been no progressive increase or decrease during the past fifty years.

It appears to be impossible to predict the approximate precipitation for any year from past records.

R. DEC. WARD

Thunderstorms at Panama. A discussion of "Panama Thunderstorms" by H. G. Cornthwaite, Assistant Chief Hydrographer, shows that thunderstorms are of frequent occurrence in Panama during the eight rainy-season months (*Monthly Weather Rev.*, Oct. 1919, pp. 722-724). The number in the interior is greater than along either coast, and more occur in the afternoon than at night or in the early morning. The average annual number of thunderstorms is from 100 to 140, which is greater than that anywhere in the United States. The loss of life and property is, however, relatively less in Panama than in many sections of the United States. This fact is believed to be due to three conditions: (1) the numerous lightning flashes between clouds which do not reach the earth; (2) the uninhabited hilltops which serve as conductors and protect the inhabited villages; (3) the atmospheric conditions which are favorable for a ready interchange of electric currents, thus tending to prevent the accumulation of powerful electric stresses or differences of potential.

R. DEC. WARD

EUROPE

A Relief Model of Wales. The National Museum of Wales at Cardiff, under the direction of W. E. Hoyle, has undertaken the construction of a relief model of that country. The work, as far as accomplished, has been done by Wallace E. Whitehouse, who has prepared a "Descriptive Handbook," published by the Museum (1915; 62 pp., 7 pls.), in which he describes his progress in making ten of the sixty-odd 18-by-12-mile rectangular blocks, corresponding to the sheets of the colored one-inch Ordnance Survey map, necessary for the completion of the whole. The blocks are on a scale of an inch to a mile with a vertical exaggeration of 2.64 to 1. Their construction is guided by 40

east-west cardboard profiles for each block, cut according to the 100-foot contours of the map; after the profiles are set up and properly spaced they are filled in with "plasticine." The generalized relief thus developed is then revised by adding details from the maps. A negative is taken in "Keene's cement," and from this a positive of the same material is cast, the surface of which is painted with white enamel; the waters are added in blue. After a negative is taken, the plasticine of the original is used again for the next block; after the positive is cast, the negative is stored for future need. The handbook describes each block separately under such headings as geological structure, relief, drainage, and human geography; it also gives half-tone views of the ten completed blocks, which, although apparently of artificially softened modulation, nevertheless clearly express the larger land forms. It is to be hoped that the model may be carried to completion.

W. M. DAVIS

POLAR REGIONS

A Recent Eskimo Migration and Its Forerunner. In a letter recently received by the undersigned from Peter Freuchen, the former factor in charge of Knud Rasmussen's trading and scientific station Thule at North Star Bay, Wolstenholme Sound, in the Cape York district of northwestern Greenland, the announcement is made of a migration of Eskimos which is under way from this district by way of Smith Sound to Pond's Inlet in the northern part of Baffin Island. Aside from its intrinsic significance much interest attaches to this movement because it represents a return to the ancestral home, the forefathers of the present band having migrated in the inverse direction about the middle of the last century. More extended reference to this is made below.

The passage in Freuchen's letter reads:

"And now most important of all—there has been a real emigration of twelve families who have started on a trip to Baffin Island to visit the Eskimos at Pond's Inlet. Most of these emigrants are descendants of the great Etukashoosuk and his companions who immigrated here from Pond's Inlet in the fifties of the nineteenth century, reintroducing the use of the *kayak* for sea hunting, the salmon spear for ice fishing, and the caribou-antler bow-and-arrow for land hunting, and profoundly altering the culture of the natives of this district at that time. The philosophical old patriarch, Esayoo, and the restless but energetic Etukashoo, great-grandson of the old immigrant leader, who were your favorite Eskimos and loyal comrades on so many miles of the long trail, lead the band; among their followers are the big Tungwe and Ooquia, Poodluna, Awigingwa, Satow, Touchingwa, and others. It is a remarkable and courageous little band that has been seized with the *wanderlust* and is now making its daring dash down the inhospitable coasts of Ellesmere Island.

"The party will winter on the northern shore of North Devon, so well known to Etukashoo as a great musk-ox pasture and haunt of the polar bear. While the party rests during the winter the hunters will seek a route over the glaciers of North Devon by which they can cross the island, and come down in the early spring upon Lancaster Sound by any one of the easy descents which some of the party observed when they were with Whitney years ago. Then they will cross Lancaster Sound and in a short time be at Pond's Inlet. I hope that the adventurous little party may meet no mishap, and that it may return intact to its own country with a wealth of experience and novel interest. I dread the contagious diseases that they may encounter at Pond's Inlet, from which they have been free heretofore."

Our knowledge of the mid-nineteenth century migration is mainly based on Knud Rasmussen's account of the story told him in 1903 by Merkrosuak, one of the original members of the party ("Nye Mennesker," Copenhagen, 1905, pp. 21-35; English version: "The People of the Polar North," Philadelphia, 1908, pp. 23-36). The following version is based on the story as told me by the same informant in the summer of 1914. Merkrosuak in 1914 was the sole survivor of the original party that set out from Pond's Inlet so many years before. He was an old man, very old as Eskimos go, but he still retained much of his vigor and skill and all his mental powers up to his death in September, 1915, from the result of too much food at the hands of the captain of our relief ship.

The story is as follows: About seventy years ago the Eskimos of Pond's Inlet were stirred by the stories the whalers told them of other Eskimos across the "North Water," i. e. on the Greenland side; accompanying the whalers, some of the Baffin Island Eskimos may even have met these "Arctic Highlanders," though no record of any such meeting has been left us. They knew that these Arctic Highlanders lived primitively in a land of much game and that they were a peaceful people.

The Arctic Highlanders, at the time of their discovery by Ross early in the nineteenth century (1818), believed themselves to be the only people in the world and their land

the only habitable part of the earth. Their traditions were rich in references to other people of a past time, but until the white men met them they thought themselves the only remnants of a more numerous and more widely extended race. They were sure that no one could live to the south, because in summer all their icebergs and ice-fields drifted thence—consequently the ice of centuries must be piled up beyond the southern horizon.

The lure of the North wrought upon the minds of these Baffin Islanders until it culminated in the decision of families to journey to their northern relatives and to establish themselves in that unexploited land of plenty. Accordingly in the spring of 1856 (this is the date worked out as the most probable by H. P. Steensby in his "Contributions to the Ethnology and Anthropogeography of the Polar Eskimos," *Meddelelser om Grønland*, Vol. 34, No. 7, 1910, pp. 261-264, 392 ff., and map on p. 401, showing the route, reproduced on the map in this number, p. 130), the party set out under the leadership of Etukashoosuk (the great Etukashoo) to seek their fortunes beyond the "North Water." Etukashoosuk was the grandfather of the Etukashoo who leads the party returning now to the old home on Pond's Inlet and whose *wanderlust*, daring, and experiences as an explorer have made him the guide and companion of many famous expeditions. The blood of the Etukashoo family runs restless, and it must answer "when the Red Gods call." The Baffin Island party started out westward along Lancaster Sound, hunting as it traveled, until finally it crossed the sound to the western end of North Devon. Here the party wintered successfully and contentedly, the while it sought out a further route across to Ellesmere Island. Game was plentiful and the party prospered.

Henceforth the story as it was told me by old Merkrosuak grows somewhat confused as to time and locality. The party moved slowly along the southern coast of Ellesmere Island, meeting no serious difficulty until it began the final stage of the journey from Jones Sound northward. Then difficulties multiplied: the equipment was worn and exhausted; the dogs were weak and few in number; the members of the party themselves were weary and dispirited, and game failed them. Mutiny and cannibalism entered into their experience.

A total failure of game forced them first to eat all their dogs; then the weakest and youngest of the party were selected as food for the stronger and older. Among the first selected were Merkrosuak and his younger brother. The younger brother was the first victim. Then, after he was devoured, Merkrosuak's turn came. A mere boy, he could not defend himself, but when they put out one of his eyes preliminary to his death, he broke away from the party and escaped to the hills. Here he succeeded in eluding his pursuers for several days; when finally hunger and fear drove him back to the party, he found that they had made a goodly kill of seal and no longer needed or desired him as a sacrifice or as food. He had lost his eye but had regained his right to live.

The fortunes of the party improved steadily hereafter, and they finally reached their "promised land" and the people they sought. The account of their first meeting with a Cape York Eskimo is amusing. As they came sledging down the coast of Greenland, they met a man who had lost his leg and had been provided by the whalers with a wooden leg. The Baffin Islanders concluded at once that all the people in this new land had one good leg and one wooden leg.

Though the Cape York Eskimos were struck with wonder at the accomplishments and the resourcefulness of the newcomers they received the visitors hospitably. The immigrants established themselves at Etah, and at first found no little difficulty in accustoming themselves to strange conditions and strange shores. But they were of good stock and with the help of the natives soon made themselves at home and familiarized themselves with their new circumstances. Their coming profoundly modified the whole culture of the Cape York tribe. For many generations the art of *kayak*-making had been lost; the making of bow and arrows from caribou antlers was another lost art—caribou and hare were even considered unfit for food; and the use of the salmon spear had likewise been forgotten. Thus the sources of food supply were decidedly limited, starvation ever threatened the whole tribe, and the number of its members was kept very small. In summer, before the ice went out, all the tribe repaired to the bird cliffs to live upon dovekies, murre, gulls, and their eggs, until the ice once again lay solid along the coast and permitted sledging and ice hunting.

All this was changed with the coming of the Baffin Islanders. They revived the art of *kayak*-making and taught the natives how to hunt the sea-game in the open water. Their daring and resourcefulness served as an example to the natives, who were eager to learn. They dispelled the old idea that caribou and hare were not human food and taught the natives how to make bows and arrows and how to hunt with them. They restored the art of salmon spearing with the three-pronged spear, an implement of which the making and the use had been forgotten.

The activities of the tribe were thus greatly extended, and the struggle for existence was made much easier. The welfare and prosperity of the tribe were made materially more certain and secure, and it began growing in numbers. The influx of good new blood soon began to be felt throughout the tribe in better, stronger men and women. It was a revitalized people that the first American explorers found.

Twice in these early years the emigrants from the Baffin Island came into contact with white men. M'Clintock in 1858 met the party on the eastern coast of North Devon while on their migration ("A Narrative of the Discovery of the Fate of Sir John Franklin," London, 1859, pp. 143-144, and Carl Petersen: *Den sidste Franklin-Expedition med "Fox,"* Capt. M'Clintock, Copenhagen, 1860, pp. 92-93), and after they had reached Greenland Captain Budington, of Hall's last expedition, in 1872 met one of the women of the party (C. H. Davis, edit.: *Narrative of the North Polar Expedition, U. S. Ship Polaris, Captain Charles Francis Hall Commanding*, Washington, 1876, pp. 450-451). Thus authenticated, the Eskimo story is a genuine part of history and worthy of a prominent place in the annals of the Arctic.

Now the sequel to the story bids fair to be as fascinating and thrilling as the original epic. The direct descendants of the old Etukashoosuk are returning to their ancestral home under leadership of the old patriarch's great-grandson, Etukashoo, who is a worthy scion of the old stock, and with the counsel of Esayoo, who is himself a grandson of the old patriarch and uncle of Etukashoo. Esayoo and Etukashoo have long considered this trip. They often talked it over with me when we were companions on the long trail in 1915, and I heard them discuss it with other Eskimos at various times. What impelled them to choose this time it would be hard to say, but *wanderlust* and a desire to see their ancestral home were undoubtedly the fundamental motives. The contemporary student of Arctic geography and history will watch with interest the outcome of the pilgrimage and wonder what the effect will be, both upon the party and upon the people to whom they come.

W. ELMER EKBLAW

GEOGRAPHICAL NEWS

Organization of the American Meteorological Society. At the St. Louis meeting of the American Association for the Advancement of Science there was organized on December 29, 1919, the American Meteorological Society. According to its Constitution the objects of the Society are: the advancement and diffusion of the knowledge of meteorology, including climatology, and the development of its application to public health, agriculture, engineering, transportation by land and inland waterways, navigation of the air and oceans, and other forms of industry and commerce. Its officers are: President: Professor Robert DeC. Ward, Harvard University; Vice-President: Dr. W. J. Humphreys, U. S. Weather Bureau; Secretary: Dr. Charles F. Brooks, U. S. Weather Bureau; Treasurer: Mr. Robert E. Horton, Consulting Engineer, Voorheesville, N. Y. The Society has begun the publication of a monthly journal entitled *Bulletin of the American Meteorological Society*. The two numbers so far issued (January and February, 1920), each of 14 pages, contain a great number and variety of meteorological notes of interest. A number of committees have been appointed to promote the activities of the Society. These and their chairmen are: Research, C. F. Marvin; Meteorological Instruction, W. M. Wilson; Public Information, C. F. Talman; Membership, C. F. Brooks; Physiological Meteorology, Ellsworth Huntington; Agricultural Meteorology, J. Warren Smith; Hydrological Meteorology, R. E. Horton; Business Meteorology, A. W. Douglas; Commercial Meteorology, H. J. Cox; Marine Meteorology, J. H. Scarr; Aeronautical Meteorology, C. T. Menoher. At the St. Louis meeting, December 30-31, 1919, and in continuation thereof in New York on January 3, 1920, no less than 29 papers were read. Joint sessions were held with the American Physical Society and the Association of American Geographers, to the latter of which reference is made in this number on pp. 139-140. The annual dues of the Society are only one dollar, which includes receipt of the monthly *Bulletin*.

GEOGRAPHICAL REVIEWS

THE POLITICAL GEOGRAPHY OF ASIA

H. A. GIBBONS. *The New Map of Asia (1900-1919)*. xiv and 571 pp.; maps, index. The Century Co., New York, 1919. \$2.50. 8½ x 5½ inches.

In the last of his three similarly named books Dr. Gibbons displays in exaggerated form both the excellencies and the defects of "The New Map of Europe" and "The New Map of Africa" (discussed in these pages, *Bull. Amér. Geogr. Soc.*, Vol. 47, 1915, p. 967, and *Geogr. Rev.*, Vol. 6, 1918, p. 379). "The New Map of Asia" is excellent in its plan but careless in its execution; the style is eminently readable, but there are many errors of fact; the outlook is broad but sadly marred by prejudice. The purpose of the book is to give in clear and succinct form a bird's-eye view of the events of the last few decades in Asia and to show how these have led to the present political situation. The author begins with the British possessions in Asia, takes up those of France and of the United States, passes on to Turkey, Persia, and Siberia, and ends with China and Japan. He has the great merit of always writing clearly and of putting things in a way that is not only easy to understand but easy to remember. Perhaps he is unduly fond of exclamation marks, but that is a matter of taste.

In spite of these good qualities the book can hardly be counted a permanent contribution to our knowledge of Asia. In the first place one's confidence in it is shaken by many little errors. For example the author speaks of England as threatening Siberia when he should say Turkestan; he refers to Bokhara as touching India; and, from failure to understand what an enormous barrier Tibet is, he assumes that that country may serve as a possible vantage point from which the combined influence of China and Japan may penetrate India. In view of the fact that the book was prepared hastily to meet the need of the moment such mistakes might be pardoned, although they inevitably cause the thoughtful reader to become suspicious of the whole volume.

A far worse mistake, however, displays itself in the entire structure of the book, namely an attempt to prove a point without regard to the facts. Before giving an example of this, it should be explained that the author's *leitmotif* is "Asia for the Asiatics," while "Down with the League of Nations" comes in as a minor theme. Hence the volume is cleverly constructed so that Asia is rarely blamed, while Europe is constantly held up to scorn. "The white man's burden" is treated with sarcasm after sarcasm. It is perfectly right for an author to take such a viewpoint, but he cannot expect recognition if he lets it distort the facts. Turkey, for example, is discussed with much sympathy, and the pros and cons are stated more fully than in any other case. The chapter on Palestine and Zionism is an admirable and well-balanced argument. But why are the Armenian massacres reduced to an incidental reference or two and to the absurd misstatement that they occurred "because the Armenians were in the path to the Caspian Sea"? Japan, too, is handled tenderly, and, while a few words of disapproval are her lot for events in Korea and Shantung, the net result is an impression that her foreign policy is "excellent and wise."

The way England is treated seems almost to indicate that the writer has a personal antipathy for the British. A few sentences will show how far the book goes in distorting the truth. "The average life of the Indian is twenty-three years; of the Englishman, forty years; of the New Zealander, sixty years." Every intelligent person knows that the difference between India and England is due to climate, while the difference between England and New Zealand is due to the fact that New Zealand is full of young, strong colonists. The old people stay at home. Yet our author would have us believe that the difference in the death rate between India and England is due to British misgovernment. Again: "In 1850 the average earning of an Indian was four cents a day. This sum fell to three cents a day in 1882 and to one and a half cents a day in 1900." In quoting this statement from some Hindu propagandist, as he probably did, Dr. Gibbons pays no heed to the fact that since 1850 the value of Indian money has increased because of the introduction of the gold standard. Even so, however, the reviewer does not believe that the statement is true, and it is ridiculous in the sense that Dr. Gibbons implies. His implication is that the average Indian today lives on scarcely more than a third of what he lived on in 1850, and this because of English misrule. Such a reduction in the standard of living would mean the death of most of the population. Once more: "The majority of the population of India goes through life without ever having enough to eat." The truth is that they have enough to eat most of the time, although,

as in practically all tropical countries, a large proportion suffer at some time during their lives. "This state of affairs did not exist before England started to drain India of her wealth. It exists in no other portion of the world's surface. It does not exist in neighboring equally densely populated countries that are not directly under British rule." It would be hard to find more untruth packed into seven consecutive sentences than in those here quoted.

ELLSWORTH HUNTINGTON

THE PHYSIOGRAPHY OF A REGION NEAR MELBOURNE, AUSTRALIA

CHARLES FENNER. *The Physiography of the Werribee River Area.* Maps, diagrs., bibliogr. *Proc. Royal Soc. of Victoria*, Vol. 31 (N. S.), 1918, Part I, pp. 176-313. Melbourne.

A large part of Victoria, the southeasternmost political subdivision of Australia, consists of a well-developed peneplain, recently deformed and now more or less dissected. An embayment of the southern coast, known as Port Philip, near the head of which stands Melbourne, the capital city, occupies part of a depressed area, or "sunkland," which is adjoined on the east, north, and west by moderately uplifted blocks, separated from the sunkland and from each other by fault scarps. This district has more than a local interest, as it was crossed by the members of the British Association during the peripatetic colonial meeting of August, 1914, on their way by rail between Melbourne and Adelaide and was afterwards more closely examined by the geologists and geographers of the party on an excursion from Melbourne under excellent guidance. The careful study subsequently made by Fenner of the Werribee River area, here reviewed, includes the western part of the sunkland and the uplifted blocks on the north and west. It summarizes the work of previous observers, adds many new details, and gives evidence of the complete acclimatization of modern physiographic methods in the antipodes.

The Victorian peneplain truncates an extensive ancient mountain system of greatly deformed and mostly resistant slates, sandstones, and quartzites with accompanying gneisses and granites. The surface of the peneplain is here and there surmounted by granitic monadnocks, as well as by occasional volcanic cones of later origin, from which basaltic lava flows are spread over large areas; but the general inequalities of the surface are so small that the existing relief is almost entirely due to the recent displacements of the peneplain blocks, some of which now stand 6,000 feet above sea level, and to the erosion of young valleys in the elevated blocks, especially near their scarped margins. The "Great Dividing Range," represented on most maps with mountainous form trending east and west about 100 miles inland from the coast, has in reality no strongly marked culminating crest but is simply a broadly up-arched part of the peneplain, from which the streams flow north to the dry continental interior and south to the ocean.

Especial attention is given by Fenner to the district traversed by the Melbourne-Adelaide railway as it passes from the western part of the sunkland—the Bacchus marsh area—to the adjacent upland, the ascent being made to the middle one of three blocks, because it is less elevated than its neighbors on the north and south. The slope bounding these blocks on the east is ascribed to a fault, trending east of north, 30 miles in length and with an average displacement of 800 feet. Near the railway a large area of the sunkland and a smaller area of the uplifted block, as well as the strong slope between them, are covered by a lava sheet, from which it is inferred that the lava outpouring preceded the block faulting and that the fault hereabouts probably consists of a number of small steplike displacements. Both the sunkland and the uplifted block are nearly level at altitudes of 500 and 1,300 feet. The railway climbs the greater part of the slope between them by making a strong loop to the south and finishes the ascent in a long cut by which the lava is well exposed. The Werribee River descends from the upland near the railway in steep-walled clefts, 800 feet deep near the scarp, in which the deformed rocks beneath the lavas are well seen. A number of minor streams incise short ravines in the fault slope and deposit "aprons" of alluvium on the lower ground.

The interpretation of this district, so well argued by Fenner, has a special physiographic interest because at the time of the British Association visit the possibility that the upland on the west had been raised above the lowland by faulting was looked upon with much incredulity by certain British geologists of limited physiographic experience, although it was accepted by their Australian guides. It is to be hoped that they may see Fenner's paper. This recalls the amusing experience on the western excursion of the International Geological Congress of 1891 in the United States—physiographic principles being then less understood than now—when several eminent European members of the party, on being led by Gilbert to see some faulted alluvial fans at the base of the Wasatch Range near Salt Lake City, mutinied against the wild American

idea that a mere break in a gravel bed could have any structural significance; and the continuity was not quelled until two days later when the dislocation of the Little Cottonwood moraines was shown to stand in line with the scarps of a whole series of piedmont gravel fans. It is interesting to add that when the Transeontinental Excursion of the American Geographical Society saw the same district in 1912, the visiting European geographers manifested no such opposition to the physiographic interpretation of these striking features as their geological predecessors had shown twenty-one years before.

W. M. DAVIS

ERADICATION OF YELLOW FEVER IN PANAMA

W. C. GORGAS. **Sanitation in Panama.** 298 pp.; map, ills., index. D. Appleton & Co., New York and London, 1918. \$2.25. 8 x 5 inches.

Major General Gorgas, who lately was reported by the press to have eradicated yellow fever from Guayaquil and vicinity, presents in this book the entire history of the fight against this scourge. Nearly half the pages are devoted to the record of the accomplishment in Havana, which is used as a background in telling of the success in Panama. The history portrays that the eradication was a fight not only against the carriers of the disease but also against the opponents of the mosquito theory and shows that even the success in Havana did not still the opposition to the work as it was being carried on and that a recommendation to the Secretary of War to relieve on the Isthmus those who believed in the mosquito theory and replace them by men of more practical views was nearly adopted. Directly after the defeat of this recommendation and with the assurance of confidence in the sanitary commission of the Isthmus yellow fever began to decrease and was finally (1906) stamped out in the Canal Zone. Similar successes are recorded concerning malaria, smallpox, and the bubonic plague. The malarial record is noteworthy. In 1906 out of every 1,000 persons 821 were admitted to the hospital on account of malaria; in 1913 this number had been reduced to 76. The vigilance of the quarantine station officials at either end of the Canal has kept the record of the Canal Zone high. The book is a story of achievements "more important than the actual construction of the Canal itself," because it has demonstrated that men can lead a healthy life in the tropics and because it will thereby open to settlement large areas of productive land.

ROBERT M. BROWN

COLONIAL RAILROADS

F. BALTZER. **Die Kolonialbahnen, mit besonderer Berücksichtigung Afrikas.** 462 pp.; maps, diagrs., ills., index. G. J. Göschen'sche Verlagshandlung, Berlin and Leipzig, 1916. 10 x 6½ inches.

An account of railroad building, equipment, operation, and management in Africa and its islands, French Indo-China, the Dutch East Indies, and Shantung. The book gives much detailed information, some of it technical but most of it adapted for all readers. The numerous half-tone illustrations are instructive; and the many black-and-white maps and the Africa railroad map in colors are very helpful, though all the maps, of course, will now need much revision.

It may be said here that among the leading questions to be settled is the route to be chosen for the Cape-to-Cairo railroad beyond Broken Hill. It was intimated, before the war began, that, if possible, the English would secure a less difficult route than that through the upper Congo valley. The way is now clear to do so by deflecting the route from Broken Hill eastward to Tabora in the former German East Africa, which has come under British control. From that point the line can be extended northward, all the way through British territory, to the south of Khartum, where the Cape-to-Cairo railroad would be completed. It was reported during the war that about a year before the struggle began England asked the German Government to permit the extension of the line through German East Africa and enlarged upon the advantages that the railroad would give to that country. Germany declined to consider the matter favorably because it was not her policy to permit foreign railroads to pass through her territory. The route the Germans declined to concede is now available.

CYRUS C. ADAMS

A SCIENTIFIC TRAVELER'S HANDBOOK

Handbook of Travel. Prepared by the Harvard Travellers Club. 544 pp.; diagrs., ills., index. Harvard University Press, Cambridge, 1917. 7 x 4½ inches.

The book, fitting into a coat pocket, is intended to promote intelligent travel and exploration. It is a helpful product and very timely, for it appears on the threshold of an era when the earth studies will be more intensively pursued than ever before. All

the articles were written by members of the club. The book covers more topics and gives larger detail than some similar works published in England, France, and Germany though it is not so voluminous. Perhaps no work of the kind gives more detail of hygiene, medicine, and surgery (90 pp.), and its suggestions under this head are adapted for all climates.

Much attention is given to travel with pack horses, mules, burros, and dogs in the Americas, the one-humped camel in Africa and Arabia, and the two-humped camel in parts of Asia; to foot transport in tropical Africa and in mountain work, etc. Route surveying covers 13 pages. Dr. A. Hamilton Rice has 15 pages on traverse surveys in South America, and John T. Coolidge, Jr., 10 pages on photography.

The chapter on geography, by Professor W. M. Davis, should help the explorer to give an accurate account of what he sees. The same writer's paper on geology is full of suggestion and counsel, especially for those who have not had long experience in extended geological field study. Professor R. DeC. Ward writes on meteorological observations. Anthropology, natural history collections, and determining position by astronomical observations are also among the topics.

OUR NATIONAL PARKS

R. S. YARD. **The Book of the National Parks.** xv and 420 pp.; maps, diagrs., ills. Charles Scribner's Sons, New York, 1919. \$3.00. 8½ x 6 inches.

Mr. Yard has been chief of the Educational Division of the National Park Service for the past six years. He is well equipped to write such a book as this. His aim is to advance the popularity of our National Parks and to help visitors appreciate the grand scenery in them. His work is educational and will tend to promote more enjoyment of the parks because it leads to a better understanding of them. Mr. Yard had the advice and suggestions of many men of science in making his book accurate and full of the kind of information that is both educational and enjoyable.

Take the Muir Woods as an example. They cover a canyon of Mt. Tamalpais, near San Francisco, and thousands of tourists visit them. Not one in a hundred of them ever knows, unless he reads such a description as Mr. Yard gives, that here is a perfect exhibit of the original redwood forest, once spread far and wide but most of it now sacrificed for lumber. Some of these trees are 300 feet high with a diameter of 18 feet. This bit of California, left untouched, shows what the redwood forest has been.

The book describes not only our National Parks (including the Hawaii National Park with its boiling lavas) but also scores of objects that are called National Monuments and are protected against vandalism. Among them are prehistoric cave houses in the southwestern arid regions, ruins of a church built by Indian converts with adobe walls six feet thick, cliff towns, cave dwellings, natural bridges created by erosion, and many other objects, natural or made by man. The book is finely illustrated by photographs.

MUIR'S ARCTIC NOTES

JOHN MUIR. **The Cruise of the Corwin: Journal of the Arctic Expedition of 1881 in Search of De Long and the Jeannette.** Edit. by W. F. Badè. xxxii and 279 pp.; map, ills., index. Houghton Mifflin Co., Boston and New York, 1917. \$2.75. 8 x 5½ inches.

The dispatch in 1881 of the United States revenue steamer *Thomas Corwin* into Arctic waters in search of two missing whalers and especially of the ill-fated *Jeannette*, which under De Long had not been heard from since 1879, afforded Muir a long-wished-for opportunity to pursue one of his favorite studies, evidences of glaciation in the Arctic regions, a quest that had always fascinated him in his more southerly field work. His book contains many concise descriptions of the results of glaciation found on the land borders which he had an opportunity to visit during this cruise both along American and Asian coasts; and a number of his illustrations show glacial valleys and ridges and other effects of moving ice sheets.

Especially interesting is his graphic account of the life of the Eskimos on the islands and along the reaches of the American and Asian mainland. Few writers have so graphically depicted them in their daily life, their hardships, and their superstitions. His book is rich in descriptions of the flora he collected on the islands and along the edges of the continental coasts. The only map is a reduction of the map of Wrangel Island made by officers of the ship *Rogers* in the same year and a merely preliminary bit of work. Muir's descriptions make a photographic impression on the mind of the careful reader. His power of vivid description is well illustrated in the passage on page 62.

CYRUS C. ADAMS

THE GEOGRAPHICAL REVIEW

CONTENTS FOR MARCH, 1920

The Recent Trans-African Flight and Its Lesson. By Leo Walmsley. (1 map, 8 photos) 149

Peary: An Appreciation. By Herbert L. Bridgman. (1 photo) 161

The World's Food Resources. By O. D. von Engeln . . . 170

Five Years of the Panama Canal: An Evaluation. By Robert M. Brown 191

The Natural Regions of the Balkan Peninsula (after Cvijić). (1 insert map, 1 text map) 199

Mackinder's 'World Island' and Its American "Satellite." By Charles Redway Dryer. (1 map) 205

Geographical Record 208

<i>American Geographical Society</i>	<i>Polar Regions</i>
Meetings of March 208	Norwegian Surveys in Spitsbergen during 1919 210
<i>North America</i>	Completion of Rasmussen's Study of the Greenland Eskimos . . 210
The Country's Health 208	<i>Physical Geography</i>
Weather and the Winter-Wheat Yield in Ohio 208	Desert Erosion as Illustrated by a Comparison Between the Algerian Sahara and the Libyan Desert 211
Snowfall on Mt. Rainier 209	Distribution of Maximum Floods 212
<i>Europe</i>	
The Distribution of Population in Southern Macedonia . . . 209	
Geographical Reviews 213	

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OUR CONTRIBUTORS

Lieutenant Walmsley was attached to the British Royal Air Force during the war and participated in the African campaigns from 1915 to 1918. The discussion of flying conditions in Africa in the present article is based on his experience at that time. Shortly before the war he had been appointed curator of the Yorkshire Universities' Marine Biological Laboratory. He has written "The Aeroplane in African Exploration" (*Geogr. Journ.*, Nov., 1919).

No one is better qualified to record Peary's achievements than Mr. Bridgman, his close friend and, as secretary of the Peary Arctic Club, the indefatigable supporter of his Polar work. Mr. Bridgman is editor of the *Brooklyn Standard Union* and a member of the Board of Regents of the University of the State of New York.

Dr. von Engel is assistant professor of physical geography at Cornell University. His work has been mainly in the field of physiography, and more particularly in glaciology, but recently he has been especially interested in the anthropogeographic problems of national development. The present paper is an outgrowth of his recent studies. Dr. von Engel has also written: "A Laboratory Manual for Physical and Commercial Geography" (1913, with the late Professor Tarr); "The Natural History of Ice" (*Harper's Magazine*, March, 1917); "The Effects of Continental Glaciation on Agriculture" (*Bull. Amer. Geogr. Soc.*, Vol. 46, 1914); "Shakespeare, The Observer of Nature" (*Scientific Monthly*, Vol. 2, 1916); and "Concerning Cornell" (1917), a popular descriptive volume in which, besides a chapter on the geography of the Ithaca region, an unusual amount of geographic material is included.

Professor Brown is head of the department of geography of the Rhode Island Normal School at Providence. He has made waterways a special field of study (see his "Our Waterway Requirements" *Geogr. Rev.*, February, 1918), devoting particular attention to the Mississippi River, whose physical geography and whose function as a pathway of commerce he has discussed in numerous papers, mainly in the *Bulletin of the American Geographical Society*. He is also the author of "The Geography of Worcester, Mass.," an excellent study in city geography.

Professor Dryer was for long professor of geography and geology at the Indiana State Normal School at Terre Haute, retiring from that chair in 1913. He was one of the first advocates in this country of the method, developed by the late Professor Herbertson of Oxford, of treating the subject-matter of geography according to natural regions, a method followed in his textbook "High School Geography: Physical, Economic, and Regional" (1913). He has also written: "Studies in Indiana Geography" (1897); "Lessons in Physical Geography" (1901); "Elementary Economic Geography" (1916); "Natural Economic Regions" (*Annals Assoc. Amer. Geogrs.*, Vol. 5, 1915); "Studies in Economic Geography" (*Geogr. Rev.*, Vol. 2, 1916).

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THE RECENT TRANS-AFRICAN FLIGHT AND ITS LESSON

By LIEUTENANT LEO WALMSLEY, M.C., late R.A.F.

When, at the end of 1918, the termination of the war with Turkey released the energies of the British Royal Air Force in the Middle East for other tasks, Major-General W. G. H. Salmond, the commanding officer, decided upon the examination and equipment of several long-distance air routes as a means of promoting peace-time aviation. One of these routes, over which he personally made a flight in December, 1918, was from Egypt to India by way of Palestine, Bagdad, the Persian Gulf, and the coast of Baluchistan. Another was a continuation of this route from India to Australia. Even before it was completely examined this route was traversed by way of the Malay Peninsula and the East Indies in November and December, 1919, by Captain Ross Smith of the Australian Flying Corps in his successful flight from England to Australia.¹ The third route was from Cairo to Cape Town (cf. map, Fig. 1).

THE RECENT CAIRO-CAPE TOWN FLIGHT

The opening of this route to airplane traffic was announced by the British Air Ministry late in December, 1919.² Within two months four airplanes started on the flight. Two of these did not get beyond the first stage of the journey, one being forced to come down between Aswan and Wady Halfa on the middle Nile, the other crashing to earth near Shereik station below the mouth of the Atbara. The third, a machine flying under the auspices of the *London Times* and piloted by Captain S. Cockerell and Captain F. C. Broome, was the first to depart. It left Cairo on February 6.

¹ For a discussion of the meteorological conditions on this route see Griffith Taylor: *Air Routes to Australia*, *Geogr. Rev.*, Vol. 7, 1919, pp. 256-261.—EDIT. NOTE.

² For an account of the laying out of the Cairo-Cape Town air route see: *Cape to Cairo by Air: How the Route Was Prepared Over Bush and Jungle*, *African World*, Jan. 3, 1920, p. 389, and W. T. Blake: *From Cairo to Cape Town: Working on the African Air Route*, *ibid.*, pp. 390-391. The course of the flights can be followed in the weekly issues of the *African World* from February 7 (with map in supplement) to March 27 and of the *London Times: Weekly Edition* from February 6 (map in illustrated section) to March 26.—EDIT. NOTE.

Proceeding in gradual stages, which were marked by a series of forced landings because of engine trouble, it reached Khartum on February 7, Mongalla on the White Nile on February 14, Jinja on the northern shore of Victoria Nyanza on February 22, finally meeting its fate, fortunately with no fatality to its occupants, at Tabora, Tanganyika Territory (formerly German East Africa), on February 27. The fourth airplane, the *Silver Queen*, piloted by Lieutenant-Colonel P. van Ryneveld and Lieutenant C. J. Quintin Brand, two South African officers of the Royal Air Force, left Cairo on February 10 and came to grief the next day at Korosko between Aswan and Wady Halfa. Using a second machine, the *Silver Queen II*, placed at his disposal by the South African Government, Colonel van Ryneveld started anew from Cairo on February 22. Khartum was reached on February 23, Mongalla on February 25, Kisumu on the northeastern shore of Victoria Nyanza on February 26, Abercorn at the southern end of Lake Tanganyika on February 28, Livingstone on March 2, and Bulawayo on March 5. Shortly after leaving Bulawayo the next day the airplane was wrecked. The aviators remained here pending the arrival of a new machine sent from Cape Town and on this, the *Voor-trekker* (Pioneer), left Bulawayo on March 17, reaching Pretoria on the same day and Cape Town on March 20, thus successfully completing the flight.

DISTANCES AND FLYING TIME

The actual flying time between Cairo and Cape Town, a distance of 5,206 miles by the air route, had been 72 hours and 40 minutes, and the average speed therefore about 72 miles an hour. Colonel van Ryneveld's flight had really begun on February 4 from the Brooklands aerodrome near London, whence he reached Cairo on February 9 by way of Turin, Rome, Apulia, the Ionian Islands, and Derna. The total distance from London to Cape Town, traversed in three airplanes, was about 7,600 miles, covered in 4 days, 13 hours, and 30 minutes of actual flying time. The flight of the *Times* machine had likewise begun at Brooklands, on January 24, Cairo being reached on February 3 by way of Lyons, the mouth of the Rhone, Rome, Malta, Tripoli, and Benghazi. The total distance between London and Tabora by this route was 5,378 miles, 2,628 of which represented the distance between Cairo and Tabora, covered in 36½ hours of actual flying time.

DIFFICULTIES OF THE TRIP

These events have clearly demonstrated that trans-African airplane flight is a far more difficult undertaking than it was first considered to be. The series of mishaps that overtook all of the aspirants—even the successful—for the honor of being the first to fly from Cairo to Cape Town seems to prove that from the commercial point of view a regular transcontinental airplane service under present conditions is impracticable.

ROUTE OF THE TRANS-AFRICAN AIRPLANE FLIGHT, FEB.22-MAR.20,1920



FIG. 1

On the newspaper map it looks very simple—a straight line between Cairo and Khartum, Khartum and Mongalla, and so on down to Cape



FIG. 2—Mouth of the Rufiji River, East Africa, from an airplane.



FIG. 3—Meanders of an East African river. (Part of airplane wing on left).

Town. But unfortunately these maps, so freely circulated of late, supply but the scantiest information regarding the geographical and other condi-

tions that are of real importance to airmen. Few maps show that two-thirds of the route chosen by the Air Ministry runs across country 3,000



FIG. 4—Mangroves fringing the shore.



FIG. 5—The real tropical forest. Note the clearing in center background.

to 6,000 feet above sea level; that the country is clad for the greater portion in dense bush and forest; that temperature conditions range from

extremes of intense damp heat to cold as severe as in northern Europe. They tell one nothing of the fierce winds that howl over the tropical highlands at certain times of the year, of the thunderstorms and rains that will transform the sun-baked veld into a lake in fifteen minutes; of the dense cloud banks that envelop mountain ranges for months at a time; of the mists that hang over valleys and swamps and render the landing of an airplane an operation fraught with the greatest danger.

The general trend and details of the great chain of aerodromes constructed by the Air Ministry across Africa may be gathered from the accompanying map. For the purpose of this article I shall divide the route into three great sections; first, the Egyptian, from Cairo to Khartum (1,040 miles); second, the central, from Khartum to Livingstone (2,600 miles); and third, the South African, from Livingstone to Cape Town (1,560 miles).

The preparation of these aerodromes has been a costly and difficult undertaking, particularly in the central and South African sections. In certain districts it was found necessary to hew down great patches of forest in order to make enough clear space, and even then the ground had to be cleared of termite heaps and leveled by hand before an airplane might land in safety. In the *sudd* country of the upper Nile, an area of 35,000 square miles, the difficulty was to find a suitable piece of dry ground. In the Egyptian section the work was not so difficult, as the flat valley of the Nile naturally afforded hundreds of suitable sites.

But, if aerodromes were the only problem, any airplane capable of flying 350 miles might make the flight. The aerodromes are, as a matter of fact, as good, and probably better than those found in England, and they are certainly superior in size, surface, and approach to the best that we had during the East African campaign. In those days we considered a rectangle measuring 200 by 600 yards a veritable Salisbury Plain.

AIR CONDITIONS

On the face of things, the Egyptian section should not present any special difficulties to an up-to-date high-powered airplane, provided that reasonable precautions in regard to loading are taken and that during the heat of the day the machine is kept at a good altitude. Under 2,000 feet heat gusts may be expected, and they are sufficient to impose a great strain, not only on the structure of the machine but also on the physical powers of the pilots. From what one can gather, the Handley-Page that crashed at Shereik was almost shaken to pieces by these atmospheric disturbances, and the crew were indeed fortunate to escape with their lives.

These heat gusts, bumps, or air pockets, as they are variously termed, naturally grow worse in the vicinity of the equator, and in the central section they become a very serious problem indeed. The heat gusts usually take the form of vertical currents or columns which rise to a height vary-

ing from 100 to 2,000 and even 3,000 feet. Frequently these columns rotate, and they rise with such force as to suck up clouds of dust, sand, leaves, and other vegetable débris. On a hot day it is quite common to see a score of these "dust devils" within an area of a few square miles, and their effect on an airplane may be imagined. It was quite a usual experience while flying in Central Africa to be shot up suddenly a thousand feet or more without a second's warning, for it does not always follow that the currents are visible. When they occur over rocks or hard, sun-baked country naturally they contain no dust.



FIG. 6—Landing an airplane hangar on Lake Nyasa.

Compensating the upward currents of warm air, columns of cold air fall with corresponding force; and these, which are always invisible, are apt to be more dangerous. If an airplane about to land encounters a big "pocket," there is every chance of its dropping straight to the ground. The writer saw three machines wrecked in this way on the East African coast.

The only sure way to avoid air gusts is to fly either at night, early morning, or late afternoon, or to maintain an altitude of at least 8,000 feet throughout the hottest hours of the day. Even at this height near mountains or in the shadow of clouds air gusts may still be expected.

It is no exaggeration to say that flying an airplane at a low altitude during the heat of the day in Central Africa is harder work than holding the helm of a fishing yawl in a heavy northeaster.

EFFECT OF ALTITUDE

Added to this problem of gusts we find, in the central and South African sections, another problem—that of altitude. I have already referred

to the great tableland that occupies the whole of the center of Central and South Africa. On an average it lies between 3,000 and 6,000 feet above sea level, and the atmosphere is consequently very rarified and lacking in buoyancy. This, coupled with the "thinning" effect of the sun's heat, makes it extremely difficult to get an airplane into the air; and the strain on the engine is so great that it may give out just at the most critical moment—precisely what happened with the *Times* machine at Tabora. Colonel van Ryneveld, who flew 3,880 miles of the journey from Cairo before his machine crashed at Bulawayo, experienced great difficulty at Abercorn (5,650 feet), the highest landing ground on the route, where he had to discard everything not absolutely essential in order to be able to leave the ground.

The effect of altitude diminishes slightly towards the southern end of Africa; but, unless a new route either by way of the eastern or western coast be chosen or unless higher-powered and greater-winged surface craft be used, there is no avoiding it.

THE TYPE OF ENGINE TO BE USED

An analysis of the log books of the persons who attempted the flight would show that the main causes of failure were engine troubles. I am not enough of an engineer to deal with this side of the problem; but I think it is worth noting that in two years' experience of flying in all quarters of Central Africa we found that the ordinary air-cooled engine was infinitely more reliable than those of the water-cooled type, and it possesses the inestimable advantage of lightness. The engines employed in all the machines entered for the Cape Town flight were water-cooled and were supposed to be absolutely the best so far as design and workmanship went. It must be remembered, however, that they were fitted to heavy machines carrying full loads and that the strain borne by them while flying through rarified and gusty air was tremendous.

WEATHER DIFFICULTIES

In addition to the ordinary atmospheric conditions, which in the central section do not vary, we have another serious problem in the weather. This in Africa is a better-known quantity than in England, for the rainy seasons and dry seasons occur with little irregularity. Unfortunately for the would-be traveler from Cairo to the Cape they do not occur at the same time throughout the route but at such periods of the year as to make it almost impossible for an airplane to have fine weather all the way. To fly across Central Africa in its rainy season is no easy matter, for never a day passes without a thunderstorm and a torrential downpour of rain sufficient, as I have already said, to turn the veld into a lake within a few minutes. In the air these storms may usually be dodged; but an airplane, unless it carries a sufficient margin of fuel, may be driven so far out of its

course as to make a forced landing necessary. A forced landing in this part of the world is full of possibilities, among which an undamaged machine is not the only one; for a landing ground, in the ordinary meaning of the word, does not exist. Practically the whole country lying between Mongalla and Livingstone consists of rolling veld or mountains clad almost without break in dense bush and forest. Even the most seductive grassy glades are pitted with termite heaps, and it is infinitely more dangerous to crash into one of these while making an otherwise good landing than to "pancake" deliberately into the bush when the branches and foliage,



FIG. 7—Typical "bush" country with baobab trees.

though wrecking the machine, usually break the fall of the occupants. Granted that the airmen escape safely from the crash, they may find they have only jumped from the frying pan into the fire. The country they have landed in may be entirely waterless; it is probably infested with lions, buffaloes, and rhinos; and, unless they are armed, they may find the march to the nearest camp, aerodrome, or village as full of adventure as a Jules Verne romance.

UNSUITABILITY OF AIRPLANES TO COMMERCIAL TRAFFIC

In spite of all these natural obstacles with which Dark Africa guards the secrets of her heart, Colonel van Ryneveld's success shows that the through journey can be made. At the same time, I am convinced that for a regular trans-African service the airplane, even when worked in relays,

is not a practicable commercial undertaking. It has been clearly proved that the heavy type of airplane is not suitable for the tropics; and the lighter type would not have sufficient cargo space to make it pay. The cost of the various relay stations, the transport of fuel and spare parts, the upkeep of the aerodromes and emergency landing grounds would be enormous and out of all proportion to the profits received from express, mail, and passenger traffic. The risk of forced landings would never be entirely eliminated, and the average business man would, I think, prefer a week's



FIG. 8—A native village seen from the air.

delay in sending an urgent letter to the risk of losing it completely. The perfection of wireless telephony will rob the airplane of its advantage as a letter carrier.

SUITABILITY OF AIRSHIPS

With the airship things are different. Here we have a machine capable of carrying a useful load and of flying enormous distances without the necessity of landing. Because of its independent buoyancy and its numerous engines and their accessibility nothing short of a total collapse would bring it to earth without the will of its occupants. But the airship presents many problems of its own. The effect of the tropical sun on the envelope would probably be very great. The expansion of gas due to the changing temperatures would be a matter demanding much thought. If an airship could maintain a height of over 8,000 feet while flying over the

tropical zone, no trouble should be experienced from gusts. The actual temperature of the air at this height is practically the same all over the world; and, if some fabric absolutely impervious to the sun's heat rays could be evolved, there would be no trouble from expansion.

In the writer's opinion, the only regular air service across Africa would be one of giant airships. It will probably be organized in three stages: the first from Cairo to Khartum, the second from Khartum to Livingstone, and the third from Livingstone to Cape Town. Sheds would be required



FIG. 9—Dar-es-Salaam, Tanganyika Territory.

only at Khartum and at Livingstone, as a protection from the heat; at Cairo and Cape Town mooring masts would be sufficient. For the first and third stages any modern type of Zeppelin would do; but for the central zone a specially constructed high-powered, sun-resisting craft would be required, capable of climbing to 15,000 feet and maintaining this height throughout the journey to Livingstone. In East, Central, and South Africa this airship service might be linked up with airplanes, and mails might be carried to their destination in one-half the time taken at present.

THE WONDER OF THE AFRICAN AIRSCAPE

If ever a Cairo-to-Cape Town air service is inaugurated, there should be no dearth of sight-seeing passengers; for Africa as seen from the air is one of the most wonderful of all countries. The flight up the Nile

would alone be an experience to talk about until one's dying day; and there is hardly a square mile of country lying between the northern and southern extremities of Africa that has not its special interest. The central portion of the route lies over a land which even yet is a sealed book so far as the white man is concerned; over vast stretches of country where the only roads are those made by roving elephants or countless herds of antelope, zebra, and giraffe; over regions of scenery absolutely unrivaled in its loveliness. A civilized country seen from the air is simply a gigantic mosaic, monotonous in its regularity; but the airscape of Central Africa is as untamed and irregular as that of the moon. Except in the rainy season fogs or mists are unknown, and only the curving of the earth limits the range of visibility. The view over the rolling sunlit veld, with its rounded kopjes and winding silver rivers, its mysterious marshy lakes, and its stupendous snow-capped mountains, is something never to be forgotten. Probably many of these scenes will be filmed, and the public may see them as it has seen the wonders of the Antarctic and the South Sea Islands—in the easy comfort of a plush-backed chair. Yet no camera or artist can ever faithfully portray the magic wonders of the African air. Only to those who are bold enough or, what is perhaps more important, rich enough to go and see for themselves will they be revealed.

PEARY: AN APPRECIATION

By HERBERT L. BRIDGMAN

A true interpretation of Admiral Peary's almost quarter-century of life work reveals it as but another, more forceful and rigorous presentation of the age-long drama in which man and nature, mind and matter are arrayed against each other. True to classic model, but penetrating much farther than did the ancient dramatists into mysteries physical and spiritual, Peary's drama was a trilogy, each part independent, self-sustaining, and to a degree complete, yet each, as the result proved, related to the others, preparing the way for the next, and all inspired and united by a common idea, a definite objective, and a continuous purpose. Some day, when the psychology of adventurers and particularly of Arctic adventurers comes to be studied and understood, it will be found that Peary's contributions, intellectual and spiritual, to the sum of human knowledge were no less valuable and memorable than were those that have been made in better known and more definitely limited fields of science, and that humanity, no less than his country, is his lasting debtor. Our present path, however, does not lie in that direction.

PEARY'S CONTRIBUTION TO THE METHOD OF POLAR EXPLORATION

Nevertheless it is pertinent to say that Peary's contributions, definite at the beginning and emphasized as the years went on and experience conformed to the plan and scope and the method and management of polar field work, were both in immediate and ultimate value second only in importance to his attainment of the Pole itself. Radical and revolutionary to the extreme, fortified only by clear Yankee common sense and the courage of his convictions, Peary, breaking all precedents and relying on his own judgment and a keen perception of the relation of means to ends, discarded at the outset the large party for the small, the ship for the land, and civilized for Eskimo modes of travel. In short he adapted himself and his party to actual conditions and environment, took the Eskimos as friends and instructors, made their customs and dress his own, and at one step mastered all that generations of human experience had to contribute in the great adventure on which he had embarked. Whether American or Eskimo was the base of the composite does not matter. No chemical "third something" ever served its purpose more thoroughly and successfully than the combination thus formed by Peary; and it is certain that to his complete understanding and masterly treatment the potency of the union was wholly due. No less a factor in progress and ultimate success was Peary's intense and dominating personality; under orders from no department or bureau, he

was responsible only to himself and his sense of duty, and, had outside authority intervened, no prophet was needed to foretell the consequences. Not only do Peary's reasoning and methods, including his long and exhausting tests, explain his final success on that ever memorable sixth of April, 1909; but Amundsen at the opposite pole, December 16, 1911, two years and eight months later, Stefansson's five years in the Canadian Arctic Archipelago, the Scott and Shackleton tragedies resulting from adherence to other methods—all are additional proof, if any were needed, not only of the absolute correctness of Peary's methods but of their vast and decisive importance in all the Polar work of the future. The magnetic needle is scarcely a more valuable aid to the navigator than is the equipment which Peary has bequeathed to every one who follows him.

PEARY'S EXPEDITIONS

The Peary drama—"Conquest of the Pole" he prophetically named it almost before it was begun—readily and naturally separates itself into a trilogy. Part One consists of the Inglefield Gulf expeditions and the four traverses of 2,500 miles of the great Greenland ice cap (1891-1895); Part Two, the Peary Arctic Club's first series of expeditions (1898-1902), including the rounding of North Greenland and the elimination of that island as a possible route under any circumstances to the Pole; and Part Three, the Peary Arctic Club's second series of expeditions (1905-1909), including the building of the *Roosevelt*, the advance to 87° 6' N., the return disabled and almost a floating wreck, and the second voyage (1908-1909), culminating April 6 and announced September 9 in the Battle Harbor radiogram "Stars and Stripes nailed to the North Pole" which electrified the civilized world. Within these few sentences are contained outlines of a story since familiar and always to be familiar to the world, deeds recognized and accorded the highest honors by geographical and other scientific societies, a landmark in history—since it takes the word "unknown" from one part of the globe forever.

SURVEY OF HIS SCIENTIFIC RESULTS

A survey of the more definite and distinctive scientific results of Peary's Arctic quarter-century must necessarily be general and in somewhat inclusive terms. The monograph which he forecast in his first volume is yet to be published, and through all his work the dominant note is action and advance rather than study and the refinements of research. Every available hour when the difficult leave from the service could be obtained was devoted to detailed plans for the coming expedition; official or organized co-operation with him or discussion of his material was to a degree beyond his command; and the exhaustive analysis and generous publication of results with which foreign governments, notably France, reward their explorers are yet to come.



ROBERT E. PEARY

Born at Cresson, Pa., May 6, 1856; died at
Washington, D. C., February 20, 1920.

GEOGRAPHICAL RESULTS

Geography naturally holds first place in an estimate of Peary's Arctic work, and, in this field, statement and appraisal are not difficult. Recall the maps and conditions of 1891, and the conclusions are convincing and immediate. Kane, Hayes, Hall, Greely, Nares, Markham in the western, and De Long in the eastern hemisphere—each had done his best, even to the supreme sacrifice, and yet had left a continuous record of defeat and disappointment, with the solution of the mystery as distant as ever. The charts ran off indefinitely above 83° or 84° N., and the dotted line which represented the limit of human knowledge had a complete radius of about 500 miles in every direction from the Pole. When Peary left Cape Columbia, February 22, 1906, the entire map of the Polar zone had been recast, and, whether he was to reach the Pole three years later or not, he had completely revolutionized our knowledge of the Arctic. Four traverses of the great Greenland ice cap, 2,500 miles of arduous sledging, had placed the flag of his country where it was nearest Europe in a cairn which he recognized eight years later; Greenland was rounded in 1900; the name of Morris K. Jesup was placed on the most northern land ($83^{\circ}29'$) in the world; and the Greenland route was definitely eliminated as a route of Polar advance. In 1906 the coast west from Cape Columbia to Sverdrup's farthest was definitely charted, Cape Thomas Hubbard was located and named, and the illusory Crocker Land was given its brief mythical existence. In view of the disappointing result of the MacMillan Crocker Land expedition eight years later, and as illustrating the exactness and accuracy of Peary's methods, it may be worth while to say that he once declared, in discussing a distant prospect, "I'll never say it's land until I have set my foot on it"; and those who can read his exact words will find that his reports of what he believed was land on that June 24 were made with clear and distinct reservations. It should, too, always be borne in mind that not only was Peary by nature and training fully equipped for discovery but that he fully appreciated the value of accuracy. Experience in determining positions and courses as a navigator on sea and as an engineer and surveyor on land, in measuring distances by comparison and average of estimates and by a mechanical odometer of his own invention, enabled Peary to construct charts and maps that have completely revised and superseded the former coast outlines and cape and island positions of Inglefield Gulf, of both sides of Smith Sound, of Ellesmere Island, and indeed of nearly the whole of the great Arctic sector between the eastern coast of Greenland and the 80th meridian west.

ETHNOLOGICAL RESULTS

Next to his work in geography, Peary's contributions to ethnology doubtless have place. Like Columbus he discovered a race; unlike Columbus he made his "finds" his friends, followers, and comrades. Penn with the Indians on the Schuylkill was no more the guide, philosopher, and

friend than was Peary among the little tribe of Arctic Highlanders. To them he brought appreciation, comradeship, and understanding which, strengthened and tested for more than twenty years, "carried on" to the Pole itself. It was Ooqueah, the Eskimo lad whom Peary first saw as a babe in his mother's hood, who proudly bore the American naval ensign in the historic moment when the Stars and Stripes were "nailed to the North Pole." Animated by keen and genuine human sympathy, Peary from his first contact with old Ikwah in 1891 entered into the daily life and experiences of his dusky comrades, shared their joys and sorrows, supplied them with the things which fitted their actual needs, and mingled kindness and sternness with equal justice, so that not only was his word law but all the tribe's resources in worldly goods and man power were always at his disposal. Peary's word with the Eskimos was always his bond, and always the faithful and deserving were rewarded far beyond the letter of the obligation. Many a time boat crews would go ashore and come back empty-handed from the villagers; the natives had nothing or were willing to sell nothing. Whenever Peary went ashore the boat would return laden; furs, dogs, anything the camp possessed were willingly yielded up not only because the immediate return was generous and satisfactory but because Peary wanted the supplies for use in his work and because nothing was too good for him.

This intimate and practical alliance, though Peary developed the scientific lines, opened up what had hitherto been a closed book. The tribe's history and migrations; what they knew of their origin—Asiatic, eastern, western; all that folklore had to tell of customs, social and domestic; a vocabulary of the Innu language; numerous physical tests and measurements; and a family register of every man, woman, and child from Peary's first landing in McCormick Bay in 1891 to his last farewell almost on the same spot eighteen years later—all these things became available. In these present days of making over the nations of the world it is encouraging and instructive to find one which has neither laws nor literature, neither money nor religion according to civilized standards, and yet holds the even tenor of its happy way in the consciousness that it needs none of them. When the next problem of dealing with subject or inferior races shall engage the world's attention, the record of Peary's dealing with the northernmost, smallest, and least-known colony of humanity will be found full of suggestion and practical wisdom.

METEOROLOGICAL AND HYDROGRAPHICAL RESULTS

In the fields of meteorology and hydrography Peary's observations and records, as might be expected, take high and definitive rank and, while complete and authoritative discussions are not available, have been of great practical value in the study and explanation of Arctic phenomena.¹ Dur-

¹ See, at the end of this article, the summary of Peary's tidal observations prepared by the U. S. Coast and Geodetic Survey.

ing the first winter J. M. Verhoeff, who never returned, kept the tidal registers off Red Cliff House in McCormick Bay, and two years later similar data with hourly meteorological observations were obtained at Anniversary Lodge. When the *Roosevelt* was ready to depart in 1905 the expedition had a definite status as an adjunct to the U. S. Coast and Geodetic Survey and its work was prosecuted with the sanction and responsibility of that bureau. At Capes Sheridan, Columbia, and Bryant data were secured which were accepted by competent experts as going far to establish, despite the Crocker Land disappointment, the existence of a large land mass or masses in the yet unknown Arctic area. The possible existence of such land masses is the chief inducement and stimulant for the airplane explorations imminent both from American and oversea bases. For the first time the phenomena of air, of sea temperature, and of tides and currents in this region were accurately measured and recorded and their results added to the sum of exact knowledge.

GEOLOGICAL RESULTS

Peary did not pose as a geologist or botanist. He posed in nothing; but that he had vision and appreciation of the forces and beauties of nature, the following description of Whale Sound is conclusive demonstration.

Fifty-five miles wide at its mouth, which is divided into two broad channels by a trio of commanding islands, and eighty miles deep, it presents every phase of Arctic scenery, climate, and life—is, in fact, a little Arctic world in itself. Along its shores are to be found low grassy slopes; towering cliffs, massive and solid, carved by the Titan agencies of the savage North into wild forms; wind-swept points where nothing can exist; sheltered nooks where never a violent breath of air penetrates; valleys where luxuriant grass is brightened by myriads of yellow, purple, blue, and white flowers; slopes and plateaus as barren as the surface of a cinder pile; huge glaciers which launch a prolific progeny of bergs into the sea; tiny glaciers which cling tenaciously in the angles of the cliffs; miles and miles of glistening blue, berg-dotted water; and everywhere a few miles back from the shore, the shore of that other silent, eternal, frozen desert sea, the "Great Ice."

Such is this region in summer. In winter it would hardly be recognized. The land is shrouded in snow and shows a ghastly gray in the dim starlight; the sea is white and rigid; no sound is in the bitter air, which is pungent with frost spiculae; light and life have fled; land and sea and sky and air are dark and dead and frozen.²

A quarter of a century later Ekblaw, the University of Illinois member of the Crocker Land expedition, and Koch, the geologist of the Rasmussen expedition, renewed and extended the work, so that now, on the base lines established by Peary and clearly outlined in his earlier expeditions before the great adventure and single objective had dwarfed and dominated everything else, the geology of North Greenland is practically established and its formations definitely assigned. In ornithology Peary was on familiar ground. As a lad on the islands and shores of Casco Bay he had collected a complete series of the hawks of that locality, and years afterward dis-

² "Northward Over the Great Ice," New York, 1898, Vol. 1, pp. 458 and 476.

played with rekindled youthful pride and enthusiasm to his Eagle Island guests the examples of his skill as a taxidermist. Every variety of the Arctic denizens of the air was known and identified by him, and no treasure of all his expeditions was more highly prized than that of the rare and almost extinct knot. Wherever his wide quest led, it was only second nature for him to find—

books in the running brooks,
Sermons in stones, and good in everything.

So, when the auxiliary expeditions of 1894 and 1895 were organizing, what more natural, not to say inevitable, than that two of the most eminent American geologists, Professors Thomas C. Chamberlin and Rollin D. Salisbury of the University of Chicago, should find place on board and welcome on shore for the complete intensive study of the entire coast and of the glaciers, advancing and receding, of every known type surrounding Inglefield Gulf—probably the most highly diversified area of such dimensions in the world for geological survey and explorations. Here could be seen at close quarters, as it were, a world in the making; all the processes of which our habitable zones are the latest familiar result may there be seen in all stages of repose and action; and the observations and deductions of these two collaborators during that Arctic summer have become accepted and recognized authority on many doubtful and difficult points for which adequate data were lacking.

PEARY THE MAN

We, of the present, are too near the man and the fact to assume authority for the final verdict on Peary and his work; but it may be awaited without misgiving. No character and no career lend themselves more readily to analysis, and none need them less than Peary's. Simple, integral, and balanced, the evolution was normal and inevitable, and the development during the twenty-three years of Arctic adventure is an interesting study in psychology. No one should think that chance or accident directed his life work. Athlete, engineer, and navigator, he had an equipment that none in his field before him ever possessed. Upon this broad and substantial foundation he built with each year's added experience a commanding personality which brought to his service all the resources of the Arctic. Eskimos and dogs alike loved and obeyed him; nothing which would serve him but yielded to his demand and his unswerving purpose.

Most interesting, too, in the evolution of the years was the development of the American ideal, of the patriotic impulse, of the consciousness that this self-imposed duty was more than personal ambition or adventure, was a call of country, an exposition of national honor, an acceptance of Nature's challenge. No one acquainted with him could come into his presence and fall under the spell of his reserved, restrained personality—for he was not a man given to many words—without a distinct impression of serious

purpose and of high patriotic resolve. It is in this character of the typical, fearless, unflinching American, first and always, of which the explorer was but a phase of expression, that he takes his place in the memory of those who knew him well and loved him best. To catalogue his achievements or cast up his account with science is unnecessary. He has written of these things in fullness of detail, and what he has written can be read by all. Not less will his example, of which he could not write, and our memories of him be possessions forever.

I drink to that great Inn beyond the grave.
If there be none, the Gods have done us wrong.
Ere long I hope to chant a nobler stave
And in some Mermaid Inn beyond the grave
To quaff the best of Earth that Heaven can save;
Red wine, like blood; deep love of friends, and song.
I drink to that great Inn beyond the grave
And hope to meet my golden lads ere long.
(Alfred Noyes, "Tales of the Mermaid Inn")

SUMMARY OF PEARY'S TIDAL OBSERVATIONS

(Prepared for this article by the U. S. Coast and Geodetic Survey)

During his last Arctic expedition in 1908-1909, Peary secured tidal observations at five stations. These observations consisted of continuous hourly readings of the height of the tide, day and night, supplemented by more frequent readings near the times of high and low water. The locations of these stations together with the periods during which the observations were made and the length of record secured are given in the following table.³

TABLE I—LOCATIONS AND PERIODS OF PEARY'S TIDAL OBSERVATIONS

STATION	LATITUDE NORTH	LONGITUDE WEST	PERIOD OF OBSERVATIONS	LENGTH OF RECORD
Cape Sheridan.....	82° 27'	61° 21'	Nov. 12, 1908 to June 30, 1909	231 days
Cape Columbia.....	83° 05'	69° 35'	Nov. 16, 1908 to Dec. 14, 1908	29 "
Cape Bryant.....	82° 21'	55° 30'	Jan. 16, 1909 to Feb. 13, 1909	28 "
Fort Conger.....	81° 44'	64° 45'	June 10, 1909 to June 25, 1909	15 "
Cape Morris Jesup.....	83° 40'	33° 35'	May 13, 1909 to May 23, 1909	10 "

These observations, because of the care, thoroughness, and understanding with which they were made, furnish definitive tidal knowledge for that stretch of the Arctic coast. They prove that the tides along the northern coasts of Grant Land and Greenland differ in many respects from what had formerly been accepted. While there are long stretches of the Arctic coast where more tidal information is urgently desired, Peary's tidal observations leave little to be desired between Cape Morris Jesup and Cape Columbia.

As indicating the care with which the observations were made, mention may be made of the fact that out of a total of more than 300 days of hourly observations, under the trying conditions of Arctic weather, breaks in the continuous records due to all causes total but 36 hours.

³ The observations themselves (hourly tide heights and time and height of high and low waters) are published in R. A. Harris: Arctic Tides, U. S. Coast and Geodetic Survey, Washington, D. C., 1911, pp. 10-30.
—EDIT. NOTE.

The series of observations of 15 days secured by Peary's party at Fort Conger has a further interest in that some twenty-seven years previously another noted American explorer had made tidal observations there. It was between 1881 and 1883 that the party under Lieutenant (now Major General) A. W. Greely secured a long and valuable series of tidal observations at Fort Conger. The remarkably close agreement in the results derived from the two series is brought out in the comparison given below.

TABLE II—COMPARISON OF GREELY'S AND PEARY'S OBSERVATIONS

OBSERVATIONS	HIGH WATER INTERVAL	LOW WATER INTERVAL	MEAN RANGE	TIDAL HOUR
Greely's, 1881-83.....	11 h. 33 m.	5 h. 20 m.	4.3 ft.	3.48
Peary's, 1909.....	11 h. 35 m.	5 h. 15 m.	4.1 ft.	3.51

In a previous expedition Peary had secured tidal observations at Cape Sheridan from November 3 to December 4, 1905. It is interesting to compare the results obtained from this short series with the results from the longer series secured by Peary in 1908-1909 at the same place, since it is indicative of the high quality of his tidal observations.

TABLE III—COMPARISON OF A SHORT AND A LONG SERIES OF OBSERVATIONS BY
PEARY AT THE SAME LOCATION

YEAR	LENGTH OF OBSERVATIONS	HIGH WATER INTERVAL	LOW WATER INTERVAL	MEAN RANGE	TIDAL HOUR
1905.....	1 month	10 h. 30 m.	4 h. 09 m.	1.8 ft.	2.23
1908-09.....	7½ months	10 h. 31 m.	4 h. 14 m.	1.8 ft.	2.24

Peary's observations are the most northerly tidal observations ever made and constitute an important addition to our knowledge of the tides of the Arctic Ocean.

THE WORLD'S FOOD RESOURCES

By O. D. VON ENGELN

Cornell University

The immediate prompting for this article was the publication recently of a book of the same title¹ by Professor J. Russell Smith. These paragraphs do not, however, purport to conform to the usual book review, nor are they intended as a criticism of that volume. Rather it is proposed to suggest some considerations, having a bearing on the problem of the world's present and future food supply, that the writer thinks need to be taken into account before one may accept *in toto* the roseate future that Dr. Smith paints.

"THE WORLD'S FOOD RESOURCES," BY J. RUSSELL SMITH

It should be said at the outset that "The World's Food Resources" is a very valuable contribution to geographic and economic literature. In it are summarized exhaustively all the pertinent facts in regard to the varied materials that are serving, and may serve, to furnish nourishment for the human race, and there are discussed the adequacy and extensibility of such auxiliaries, like the nature and number of beasts of burden, that are a necessary part of the equipment for most food production. The book is very entertainingly written, and its material is organized even better than that on the same subjects in the author's earlier volume on "Industrial and Commercial Geography," from which considerable portions have been abstracted and fitted into the new book. Certain *lacunae* in the former book have been filled in, and as a whole the new work presents a very complete inventory and analysis of the wide field its title indicates.

If any fault is to be found, it is that Dr. Smith has not provided us with nearly as many references as he might have done and that he does not cite in full those that he does give, for example one to the *Manufacturer's Record* on pages 321 and 322. That the author has carefully gone over the voluminous source material on his subject is quite evident. It would have been more helpful if he had culled out for us the best of this and thus spared the reader the necessity of making an arduous search when additional or original information is wanted on a given point.

PRESENT AND FUTURE SUFFICIENCY OF WORLD'S FOOD SUPPLY

The writer, having now conformed, at least in part, to the requirements of a review, may be permitted to revert to the particular phase of the subject which it is proposed to enlarge upon in this article and to consider it from a different angle. That is the question of how amply and how well

¹ J. Russell Smith: *The World's Food Resources*. 634 pp.; maps, diagrs., ills. Henry Holt & Co., New York, 1919. \$3.50. 8½ x 6 inches.

(in richness and variety) the world can supply food to present and future human populations. Dr. Smith's position, maintained through all his pages, is well indicated by his beginning of Chapter VIII on "Meat, Men, and Land," where he writes: "Perhaps some reader of this book, seeing statements of the great and in some cases almost indefinite possibilities of increase in breadstuffs and bread substitutes, has come to the conclusion that the author is an incorrigible optimist, touched perhaps with unreason." It is not quite so bad as that, but it should be said that Dr. Smith's statements in regard to the indefinite extensibility of the supply of food materials, while entirely warranted by the facts as he presents them, must nevertheless be accepted with a number of reservations, the need for which the incautious reader will not perhaps perceive, because of the presence of positive sentences like "Agricultural overproduction, not famine, is the problem of thousands and thousands of American farmers" (p. 157). On the other hand it is only fair to say that these limiting factors are suggested every here and there through the pages of "The World's Food Resources," but they are never made emphatic, and what is hid in their shadows may easily be overlooked in the genial sunshine which floods by far the major portion of the pages.

MEANS OF EXPANDING THE FOOD SUPPLY

Expansion of the world's food supply, in order to feed the present human population more adequately or to provide for future greater numbers, may be possible by a number of means. These can be concisely summarized under the following heads:

(1) *Geographical extension of the areas of food production* by:

(a) Occupation of lands adapted to crop or animal production which are as yet inaccessible or only sparsely peopled or inefficiently used, and by swamp drainage and desert land irrigation.

(b) Utilization of lands now too cold or too dry for growth of crops by development of new varieties of food plants that can survive these hard conditions.

(c) Recovering for food production lands now used to grow crops the yields of which are devoted to the arts and industries.

(d) Recourse in greater measure than now to the seas for food.

(2) *Increasing yields per acre* by:

(a) Plant breeding to develop varieties giving higher yields at no greater labor cost.

(b) Substitution of plants giving high return for those now cultivated giving comparatively meager yields.

(c) Dependence on perennial and more certain tree crops instead of so largely on difficultly reared annuals.

(d) Intensifying agriculture by expending more human effort per acre than now.

(3) *New inventions and discoveries, as:*

(a) More complete utilization of crop produced, as by ensilage of corn for cattle feeding or using cottonseed for edible oils.

(b) Utilizing mechanical energy to make possible greater yields per unit of human effort, as by farm tractor.

(c) Improvement of transportation facilities and devices to make all areas available for the crops for which they are best adapted, as by refrigeration to make possible greater supplies of tropical fruits.

(d) Increased volume and quality of fertilizer supply by recourse to new sources, as nitrogen from air through electrical power.

(e) Improved methods of culture and seed selection so that without greater effort higher yields are obtained, as by terrace plowing to conserve rainfall and soil, by spraying fruit, etc.

(f) More general and more efficient storage and better preserving methods so that perishable commodities can be kept for long periods, as by dehydrating vegetables.

(g) Better systems of distribution to prevent the wastes due to so-called overproduction, as by eliminating such procedure as shipping green produce from area of production first to central-market middle-man, then back to retail area which is in region of original production.

This is an impressive list of possibilities and a quite reassuring one when the vistas opened up by even a single item from among the various sub-heads are considered. Just because the prospect is so alluring, however, it is worth while to pause and remember that many of these possibilities have long been open but that mankind has nevertheless in places and at times experienced the pangs of hunger and that, while famines have not oppressed the rich and sparsely populated Western world very severely in the years preceding the world war, starvation has been the fate of millions almost every year elsewhere, for example in India and China. Why should this be so?

THE SMALL MARGIN OF PRODUCTION OVER CONSUMPTION

Because, first of all, the margin of food production over food consumption in any one year is very narrow. As measured by excess of exports over imports the wheat crop, which of food materials has the most important place in international trade, shows a surplus in normal years (before the war) of a little over 1 per cent of the total production, only 44,000,000 bushels remaining as a probable carry over from all the 3,823,000,000 bushels grown.² Years of high yield of wheat in one area are in general offset by a partial or complete failure in other important producing areas; thus the Argentine crop was practically a failure in 1917 owing to drought, while in the United States there was an exceptionally good crop both in

² G. B. Roorbach: *The World's Food Supply*, *Annals Amer. Acad. of Polit. and Soc. Sci.*, No. 163, Vol. 74, November, 1917, pp. 1-33; reference on p. 9.

1914 and 1915. Even if there should be a succession of good years in all important growing areas, no provision exists for carrying over the surplus into the lean years that must follow. Any large excess of production of so staple a commodity as wheat simply brings about an automatic reduction in the price over that period, with the result that some of the normally underfed groups of the world's population are able to satisfy their cravings more fully. Ancient Egypt prospered for thousands of years with plenty of food always, it seems, for even the humblest slave, apparently because of the collection of taxes *in kind* and their storing in the national granaries against the deficiencies of succeeding years when the life-giving Nile flood might not rise to its average level. The story of Joseph is the record of how greatly this political economy of the agricultural Egyptians impressed the shepherd nomads, who could make no such provision for lean years.

PRÉVALENT DEPENDENCE ON HOME PRODUCTION

Wheat is exceptional in that it enters so largely into international trade. Most of the food produced in the world is consumed at home and very largely in the immediate district where it is grown. In bushels, potatoes, in food value, rice much exceed the total production of wheat, but both serve almost exclusively only to feed the peoples who grow them. Corn, another great food, likewise plays little part in feeding alien nationalities, except that in times past, and again recently, much of the large United States crop goes abroad in the form of the elaborated product, pork. Meat from foreign shores, if dairy products be excepted, is of little significance in the rationing of nations. All the variety and vast bulk of perishable foods move only short distances from their sources. The ancient success of Egypt was due to the fact that in the simple life of the time it was a self-sufficing country; food was practically the only need of its population, and food the irrigated Nile Valley and delta produced plenteously. Geographers now write much of the increasing separation of the home and work space on the one hand and the sustenance space on the other. As a matter of fact they are still quite close together, so far as the bulk of the world's population is concerned.

COUNTRIES DEPENDENT ON IMPORTED FOOD

Here it may be objected that, while it is true that a very high percentage of the peoples of the world are still dependent for existence almost exclusively on their home production of food (80 per cent of the working population of India is engaged in agricultural pursuits), it is also true that under modern conditions other prosperous and large groups get a large proportion of their food from abroad. Thus Great Britain before the world war imported 47 per cent of the food requirements of its 45,000,000 inhabitants, and Belgium 43 per cent of the needs of its 7,500,000. These are, however, exceptional instances; the other important food-importing

countries, Italy, Germany, France, and Austria-Hungary, did not attain nearly so high percentages of food imports to total food needs.

But Great Britain and Belgium did succeed in supporting their populations largely on imported foods, and this fact immediately leads to the conclusion that such practice may be much extended. It is argued that the expansion of all Western Europe in population and prosperity has been due to the utilization of the vast new lands of North America and elsewhere for the production of a flood of new food. But this ignores the true inwardness of the situation. It was not the knowledge of these virgin lands nor even their occupation that made cheap imported foods possible. Rather it was the fact that between the years 1870 and 1890 the transportation of bulky products was revolutionized. Had it not been for that development the production of surplus foods in outlying regions would not have occurred, as indeed it was not large before 1870, though a large part of these lands were then available. Between 1870 and 1890 railroads multiplied, steamship capacity was doubled and quadrupled, speed of service was increased, charges much decreased. In 1869 it cost approximately 37 cents to transport a bushel of wheat from Chicago to Liverpool, in 1905 only about 10 cents.³ Even so, the change to dependence on imported wheat was in Great Britain brought about in part fortuitously, for between 1853 and 1873 agriculture was prosperous in the English lands, only 10 per cent of the people being fed with imported wheat, while 1876 and 1877 were bad years in English crop production, and this fact, coupled with the expansion of transportation facilities up to the present, is responsible for 90 per cent of Great Britain's wheat consumption being supplied after 1906 from other lands.

TRANSPORTATION COSTS AS A HINDRANCE TO THE EXTENSION OF FOOD-PRODUCING AREAS

The same factor of transportation cost is now as much effective as ever. As Dr. Smith himself points out,⁴ London is the price-setting market for wheat, and eastern Idaho is a traffic divide for wheat moving east or west to that market. In eastern Idaho the producer, accordingly, receives of all growers the lowest price for his wheat (if an export surplus is grown in his district⁵)—in a given year 30 cents less than the price at Chicago. In Persia a distance of 300 miles makes the difference between \$1.00 and \$10.00 as the price of 650 pounds of wheat, and the excess supply of the rich oasis rots because the transportation cost over this 300 miles is even greater than the price difference.

Apply this principle next, then, to the vast marginal lands in Canada

³ F. A. Ogg: *Economic Development of Modern Europe*, New York, 1917, pp. 162-165.

⁴ J. Russell Smith: *op. cit.*, pp. 33-34, and L. B. Zapoleon: *Geography of Wheat Prices: Summary of Conditions Affecting Farm Prices of Wheat in Different Parts of the United States*, *U. S. Dept. of Agric. Bull. No. 594*, Washington, D. C., 1918.

⁵ C. S. Seofield: *The Geographical Factor in Agricultural Industries*, *Geogr. Rev.*, Vol. 1, 1916, pp. 48-49.

and Siberia that are adapted to wheat production. Every additional mile that wheat growing is extended beyond the present limits (with existing *routes*, not *lines* of transportation) means that the London price must be a fraction higher if the grower in those remote regions is to find his occupation profitable with equality of sacrifice. Moreover, any rise in price means that in the nearer wheat lands some intensification of agriculture will pay, that is more human effort can be expended in cultivation of the crop with expectation of a higher yield. The law of diminishing returns of course puts a limitation on the possibilities of profitable intensifying, but considerable increases in yield can be attained without too much expenditure of effort in the older lands; hence this fact, together with the increased cost of transportation, makes the occupation of the outlying lands a slow process and one that only comes about as an accompaniment of distinctly higher prices, that is an increasing handicap on the import of food by peoples whose production is deficient.

THE DILEMMA OF INCREASED SUPPLY OR LOWER STANDARDS OF LIVING

Dr. Smith recognizes this situation, too, but argues (pp. 413 and 412-413): "We may have to choose some day between more and more mechanical goods and more food." "The most conspicuous feature of the conditions of living in America, and to a large extent also in England, France, and Germany during the last twenty-five years, has been the rising standard of living— five million automobiles [owned] by the people of the United States , millions of phonographs in the homes alike of workmen and millionaires , without any appreciable reduction in the sale of any other kind of goods, save carriages." Again (p. 239): "No discussion of unused meat resources should cause us for a moment to forget the fact that there is no prospect of permanent relief in sight. That small minority in the Western World who have so nearly monopolized the world's meat will have to reduce their consumption."

In other words, increase in the world's food supply is indefinitely extensible at the cost of reduced standard of living, sacrifice of comfort—until perchance all the world's population sinks to the level of India's hordes. Pleasant prospect. On the contrary, increase in the world's food supply means nothing unless we can keep all we have of mechanical appliances and increase their number, automobiles, phonographs, bathtubs, "movies," clothes, etc. It is pointed out that Canada has for years offered 160 acres of rich level prairie land, adapted to wheat raising, for the taking; but also that this land is twenty to thirty miles back from the railroad, is bleak, windy, and often quite treeless. It might be added that it is fearfully cold in winter, that fuel is difficult to get, that house-construction material is very expensive, that there is no social life. How eager is the reader to quit his present work to go out to this rich prairie and add to the world's food supply? Similarly if we need to give up meat and wheat

and resort to the equally nutritious but less palatable rye, barley, maize, millet, soy beans, acorns, and coconut butter, our joy of life declines so much. It may be that we are capricious and conservative in our choice of foods, but the fact remains that the Russian peasant prefers wheat bread to rye bread when he can afford it; and the circumstance that Kaiser Wilhelm "used occasionally to trade the white bread of the palace kitchens for the black rye bread of a peasant boy," as Dr. Smith tells us (p. 74), may have been one of the Kaiser's few endearing acts, but it is also another example of his preferences that we do not care to adopt as a matter of necessity. (Incidentally, it is extremely curious how this idea, that the whims of royalty are an adducible argument in favor of the acceptance of any given notion, persists, even when such a personage as Wilhelm must be cited. One could understand a professor's pointing out that another learned man preferred rye bread to wheat bread, but this other idea is evidently a mental survival from the Middle Ages.)

There are, of course, commodities that the world can well dispense with and thus have more energies available for the production of food—alcoholic liquors, for example. It is a rather curious fact that, in the voluminous newspaper and magazine discussions on the subject of extravagant spending and prohibition in the United States, so little appears about the effect of diverting the millions formerly spent for drink to the purchase of other commodities, not to mention the conservation of all the grains and other agricultural products that were needed to produce such beverages. In this there has been a real expansion of the food supply, coincident with increased purchasing power for other comforts.

"HUMAN NATURE" AS AN OBSTACLE TO EXTENDING FOOD-PRODUCING AREAS

A mere searching out of the geographic possibilities of extension of food resources that does not take into true account varied human traits is apt to lead to very unsafe deductions. Argentina has fine wheat lands, so located with reference to transportation lines and the London market that their product could be very profitably sold at prices prevailing before the war. But vast tracts of this land are in the possession of a few owners, who derive incomes entirely adequate to their luxurious tastes by using the lands for sheep pasturage only; and this disposition of their acres leaves the owners much more free to pursue lives of pleasure than when they are bound down by the exacting superintendence necessary to make a success of wheat growing. Again, quoting Dr. Smith once more (p. 524): "It is generally expected that thousands of soldiers, for years freed from the restrictions of city life, will insist upon the freedom of out-of-doors." Quite the contrary, however, proves to be the case, as might indeed have been surmised if the prophets themselves had had the experience with the out-of-doors which the soldiers had. A little out-of-doors, a camping holiday, is a lark to the city dweller, but the doing without all the customary

comforts and conveniences, warm baths, clean clothes, theaters, stores, and books, for indefinite periods of time arouses rather, in the urban born and bred, a fierce longing to be once more and for always provided with city surroundings. And if the soldier did have ideas of developing government land, it is more than likely that his city-bred girl would look askance at the idea of becoming a pioneer's wife. Hence the notion that the Mississippi River swamps will be reclaimed and made food-producing by the returned soldier must be dismissed as an idle dream. Even where conditions for going on the land are most favorable, as on the government irrigation projects, it is said to be difficult to get settlers, because these lands do not give any promise of a speculative profit—they offer a livelihood but not the opportunity to sell out shortly at a large increase to some other fellow. Something of the same nature will prevent the wider utilization of tree crops. While the return from tree crops may be handsome, after a number of years, the wait often occupies so large a part of a man's lifetime that few have the faith and patience, to say nothing of the necessary capital, to plant such a crop. And success is by no means assured: a grove of chestnut trees may succumb to the blight, of oranges to a frost, of coconuts to a hurricane or to bud rot.

POPULATION INCREASE

What has already been suggested will suffice to indicate that the world's food supply cannot be expanded indefinitely as easily as one slips on an old shoe. On the other hand the numbers of people who need to be fed do seem to expand with something like that kind of facility. Since 1800 the world's population has increased from 640,000,000 to 1,693,000,000, or nearly tripled in a century and a fifth. Moreover, the greater part of this expansion has taken place in those countries which have been affected by modern Western civilization.⁶ Europe, which in 1741 had an estimated population of 127,000,000, in 1914 was occupied by 452,000,000. Under British rule, accompanied by introduction of the devices and discoveries of the Western world, the population of India increased in 39 years from 186,000,000 in 1872 to 244,000,000 in 1911, or by some 58,000,000 souls. In Japan the population increased from, in round numbers, 33,000,000 in 1871 to 54,000,000 in 1914. Of two periods, "each of 43 years, one just before and the other just after the opening of Japan to influences from Europe," "in the later period population increased three times as fast as in the earlier."⁷ In North America, in Australia, New Zealand, South Africa, Egypt, Argentina, Java, and the Philippine Islands, the same sort of tremendous expansion of population has taken place, a phenomenon probably without precedent in history, the possible exception being ancient Egypt.

⁶ W. F. Willcox: *The Expansion of Europe in Population*, *Amer. Econ. Rev.*, Vol. 5, 1915, pp. 737-752.

⁷ Willcox, *op. cit.*, p. 750.

On the other hand, according to the best evidence available, there has been but little if any increase in the population of China between 1850 and the present time. In the heart of Africa it is estimated that there has been a reduction in population in 32 years of 70,000,000 people—from 206,000,000 in 1882, to 136,000,000 in 1914. Meanwhile, however, the comparatively few thousands of negroes carried to the Americas as slaves had increased so that they numbered 13,000,000 in 1915.

THE CLOSE RELATION OF POPULATION GROWTH TO FOOD SUPPLY

What is the significance of these facts in regard to population growth or decrease with reference to the food supply? Essentially it is a verification of the Malthusian doctrine that populations tend to increase as fast as the food supply. This can be otherwise put by saying that the increase in numbers that normally accompanies the availability of more food prevents any improvement in the standard of living. Thus the British and the Dutch, by introducing new methods for increasing the efficiency of agricultural labor and extending its scope in India, Egypt, and Java, without at the same time changing the cultural status of the coolies and the *fellahîn*, have not, so far as these natives are concerned, materially improved the food situation. Accompanying the increase in income from their lands has come such an expansion of population that they are as near famine and starvation as ever. In Japan, similarly, no appreciable improvement in the standard of living of the mass of the people appears to have accompanied the increase in population, though the productivity of the country as a whole has been increased by the absorption of the energies of these greater numbers in the development of machine manufactures and shipping. It is said that before the world war Japan was reclaiming each year an area sufficient to feed 200,000 people and that new lands, available to be reclaimed, will provide for 30,000,000 more at the present standard of living; but this prospect loses all its impressiveness when it is offset by the fact that in the last 43 years the population of Japan has increased at the rate of about 500,000 people per year. It is true that a comparatively few Japanese, Indians, Dutch, and British have become enriched in the process of expansion and improvement of methods; but no larger surplus of food has resulted, nor has there been any more food per coolie available in those countries than there was before.

EFFECT OF THE WAR

It does not suffice to assert that population does not increase in geometrical ratio over large areas for long periods of time and that there is therefore no danger of a food shortage, for very evidently the figures indicate that population has been increasing with extraordinary rapidity for considerable periods and over all the areas in which we are most interested. The effect of the war on food supply furnishes a confirmation of

the conclusions that such facts suggest. Sources of food normally available to the Western world were then shut off, because of lack of shipping and the war blockade and because millions of men were diverted from crop production to war work. In effect both these changes were the equivalent of a great increase in population. Was there immediately available an enlarged food supply to meet the new need? War rationing and the present plight of much of Europe and the rate of exchange even for English pounds is the sufficient answer. Despite the stimulus of higher prices and the adoption of many expedients that made possible an actual net gain in food supplies and a lower standard of living even in America for the war years, there is a shortage. Recovery seems possible only by condemning the European peoples, particularly, to a still lower standard of living than prevailed before the war. The same trend is indicated in America by the reiterated editorials against extravagance which are to be interpreted simply as admonitions to reduce the standard of living and expend more energies (increase production) that food supplies and capital accumulation for the further extension of food-producing areas (by increasing transportation facilities, for example) may be made available. More food, yes, at the cost of the expenditure of a greater proportion of the total sum of human energy to meet the needs of an increasing population.

REASONS FOR NON-INCREASE OF POPULATION OF CHINA AND INTERIOR AFRICA

Why has the population of China remained stationary and that of interior Africa actually decreased during practically the same period in which these tremendous increases in population were occurring elsewhere? Not because births were any less numerous in China or Africa, but because the deaths equaled or exceeded the number born. The causes of those deaths are illuminating. In China famine, flood, pestilence, and civil war devoured the natural increase of normal years. In 1849 some 14,000,000 Chinese perished of hunger. And it may be concluded that if pestilence, disaster, and civil war (itself probably the result of hunger) did not clear off the surplus population so often there would be more famines to bring about the same results. In Central Africa the same conditions apply, plus the effects of the overland slave trade. Here Western civilization secures the products it wishes from the country without introducing any devices to increase food supply, and as this means that the energies of a certain proportion of the natives (while they continue to live and require food) are diverted to other tasks, the efforts of the rest, using the old methods, will not suffice, and some must perish.

GREATER EFFICIENCY IN PRODUCTION THE CHIEF HOPE FOR THE FUTURE

The prospect so far presented seems altogether dismal and in entire contrast with Dr. Smith's optimistic anticipations. But the future is not altogether dark. The possibilities that promise an increase in food supplies,

without a corresponding increase in human effort, have been ignored (except by inference) in the preceding paragraphs and must now be taken into account.

The fact is that a popular misconception of what are the really significant possibilities for obtaining an enlarged food supply has prevented a rational understanding of the subject. Writers, generally, have so much emphasized the future importance of the geographically unused land areas of the world, particularly the tropics, that the public has been fascinated by this lure to such an extent as to ignore other factors that will more certainly fulfill expectations. The chief hope for the future lies in the promise of greater efficiency in production by the human race itself. Every device and every discovery that leads to enlarged food production without also entailing more human labor may be counted as contributing to a net gain in the world's well-being, provided that such increase in food is not absorbed by an increase in population of equal consuming capacity. Even if the total quantity of food now produced, relative to population numbers, is not increased, if only a proportionately lesser number of workers are able to produce as much food as is now available per person, there will be a gain, for the toilers who are thus released can devote their efforts to the production of other commodities for our comfort. Contrariwise, if some new invention in mechanical processing of materials makes possible the same output with a less number of operatives, then we have so many more individuals available for the intensification of agriculture—similarly a net gain. It is said that an increased wage paid an Indian coolie ordinarily results merely in his being willing to work only five days in the week where before he worked six, even though his hunger is not fully appeased. The sacrifice of toil is to him greater than the internal pangs due to insufficient nourishment. It has been found that this aversion to toil is largely due to the effects of the hookworm disease; hence eradication of that ailment in India, as in the American South, will make the coolie, like the negro, more productive without subjecting him to greater physical wear than he now endures.

It has been suggested in an earlier paragraph that the extension of wheat growing farther into northwestern Canada under existing conditions would afford no relief because such an extension could only be made possible by a rise in price. Additional railway lines would not help *unless* they shortened the distance over which transportation was necessary. Hence, also, when the railway line from these areas to Hudson Bay is completed, an immediate great gain will have been achieved, for then this region will have a shorter outlet to the seaboard, with the attendant cheap transportation of ocean carriage, and its wheat crop can enter the London market at a profit at the present price level. Again, if some mineral product of high value and small bulk should be found in the Canadian region, and farmers adjacent could grow the food necessary to support the mining population,

the problem of utilization of these areas would be solved. This is the function of vegetable and meat production (cattle, reindeer, yak) in northern and interior Alaska in connection with gold mining there. If any person is dazzled, however, by the apparent possibilities of unlimited extension of agriculture into distant undeveloped lands he should read, for an appreciation of the true economic situation, Scofield's account⁸ of the problems of the farmer in a remote irrigation area.

VALUE OF MACHINE PROCESSES

Machine seeding and harvesting and the roller process in flour making, combined with the development of railroad and ocean navigation, provided Europe with bread made from hard spring wheat. The recent application of machinery to rice growing in Texas and Louisiana promises to bring about a similar reduction in the cost of growing that grain. Even now, with high-priced labor, it is possible to produce rice there at a lower cost than can the cheap coolie by his garden cultivation. In actuality the agriculture of China, particularly, is wasteful and inefficient in many respects, and we may see the day when machines will produce more rice with less labor in China than its struggling millions have ever made the earth bring forth. Our old farms and the old crops are having their labor costs reduced by the farm tractor; its use will make profitable the development of lands climatically uncertain, as one or two crop failures in five will not spell the disaster that would ensue with horse cultivation; similarly the tractor will permit the fallowing of land for alternate year cropping. The centrifugal separator and mechanical milkers have in like manner reduced dairying costs.

SCIENTIFIC AGRICULTURE

Varieties of wheat requiring a shorter season to mature or made drought-resisting by plant breeding, of potatoes and sugar beets bred to give higher yields, selection of peaches with green bark to prevent too early budding and frost injury, larger yields from the same fields by introduction of alfalfa hay, the soy bean, and the peanut—all make for true gains in the total food supply. Fertilizers from new sources, nitrogen from the air, and coke-oven by-products, phosphorus from the blast-furnace refuse will also enable the same acres and the same labor to produce additional food.

More scientific practice of agriculture, generally, can do much to enlarge the food supply. By terrace plowing, water pockets, and use of explosives moisture may be conserved and soil erosion prevented. In Hawaii the rows of sugar cane are covered with paper which the young shoots of the cane can penetrate but which prevents the growth of weeds. Ensilage permits the use of all the corn plant; animal industry carried on in connection with ensilage feeding enriches the farm with manure; crop rotation of the proper kind keeps farm labor busy at all seasons; the hog can be used

⁸ Scofield, *op. cit.*

to harvest peanuts, goats to crop steep hillsides, sheep can be made profitable by eliminating the useless dog. In Brazil the Indian zebu⁹ has been introduced because it has been found that such hybrids are immune to tropical cattle diseases (particularly Texas fever) and give fine meat; in Germany the same hybrid is found to be resistant to tuberculosis. Cattle raising in all the warm parts of the world where pasturage is abundant the year round is thus made possible. In Africa a cross with the zebra is providing a similarly immune work animal. As it has been established that salmon return to the stream in which they were born it will be profitable for privately owned canneries to conduct hatcheries and assure themselves of a perennial run of fish.

Tree crops also promise much. Spraying assures saving the yield of many fruit orchards; it has been found that orchards on slopes escape frost damage. With proper mulching it may be possible to grow olives on the American Great Plains. Indigo chemically produced has freed lands for food crops, as may also synthetic rubber. The cotton seed and the palm kernel are no longer wasted, the coconut by chemical treatment yields a substitute for butter fat, maize now supplies us with corn oil and corn syrup.

BETTER FOOD CONSERVATION AND DISTRIBUTION

Modern dehydration, without destroying flavor, enables us to conserve the seasonal oversupply of perishable vegetables without recourse to expensive canning, particularly the difficultly stored sweet potato and the watery tomato. If, in addition, we can bring ourselves to accept so much of socialistic doctrine as to provide for public purchase of conservable crop surpluses in any one region and store them in government-owned warehouses, we can at once insure the grower and stabilize prices. Dried milk is already on the market. Improvement in refrigeration may make available such tropical fruits as the dasheen, the plantain, the avocado, and the mango, as well as the banana.

Better transportation and distribution will permit wider use of materials that now often go to waste. A barge load of apples from the northern New York region tied up at the East Side in New York City would find a ready sale. Motor trucks permit outlying farmers to grow green vegetables for city consumption. The dispersal of industry to suburban districts will make chicken raising and bee keeping possible for the workman. An acquaintance got 600 pounds of honey from hives in his back lot during the season of the sugar shortage.

Most of these items Dr. Smith suggests, as well as others of similar nature that his wider knowledge permits and which have been missed here. Every one of them opens, or has opened, the possibility of a larger food supply at no increase in human effort. Taken together they afford promise

⁹ See *Bull. Pan Amer. Union*, Vol. 40, 1915, pp. 674-679, quoting B. H. Hunnicut and José Maria Dos Ries from *Journ. of Heredity*, May, 1915.

of enough to eat in the immediate future. But their general nature will sufficiently indicate that time is needed to bring them into play. We are not threatened by any avalanche of new food in the next few years. Will population growth in the meanwhile outstrip inventive genius for providing food increases? Perhaps the best preventive for that will be a world insistence on a higher standard of living in all countries, as the surest method of checking the poverty swarming that now obtains in some areas.

CERTAIN RECENT DISCUSSIONS OF THE FOOD PROBLEM

The argument thus far has been general rather than specific. Therefore it seems due the reader who has been sufficiently interested in the subject to pursue it to this point that recent detailed discussions of various phases of the general problem be brought to his attention, as indicative of the sources from which information and opinion on the several factors involved may be gained.

The "Geography of the World's Agriculture," recently reviewed in these pages,¹⁰ contains, in addition to its many valuable maps and accompanying discussions of the distribution and production of the world's food crops, on pages 148-149 a bibliography of the more important statistical sources on agricultural production in all parts of the world.

INTERNATIONAL APPORTIONMENT SUGGESTED BY WAR CONDITIONS

Reference has already been made to an article by G. B. Roorbach in the *Annals of the American Academy of Political and Social Science*. All the November, 1917, number of this publication is devoted to the general subject of "The World's Food." The contents comprise about three dozen different articles, each by a different author, grouped under four heads: "The World's Food," "Food Utilization and Conservation," "Production and Marketing Plans for Next Year," "Price Control." The article by Roorbach bears most directly on the general topic of the present paper and contains much interesting matter in the way of comparative statements of food production and consumption in the different countries. Roorbach's main contention is that in any one year the margin of food production over food consumption is very narrow. Written at the crisis of the war, it is only natural that the chief emphasis of all the papers should be on the immediate problem of war needs. Nevertheless, B. S. Butler, in a contribution on "International Rationing" predicts (p. 40) that the after-the-war period will see the adoption of some scheme by which all raw materials, including food, will be internationally apportioned. Thus Italy, for example, will engage to sell the United States a certain bulk of olive oil only on the basis of receiving from us a fair exchange value in raw materials of our production which Italy lacks. The present tendency,

¹⁰ V. C. Finch and O. E. Baker: *Geography of the World's Agriculture*, Office of Farm Management, U. S. Dept. of Agric., Washington, D. C., 1917. Reviewed in the *Geogr. Rev.*, January, 1920, pp. 74-76.

because of the collapse of international exchange, to international barter of commodities, is, in this connection, suggestive.

Representatives of the neutral nationalities each present the plight of their country in respect of food, and, while we may, without malice, assume that they made their several needs appear as urgent as possible, there was probably no downright overstatement. Fridtjof Nansen points out (p. 44) that, despite the fact that in many years emigration from Norway was greater than one half the increase in population by birth and in some years equal to the total of such increase, that country's increase in population during the last century had nevertheless been the greatest in all Europe and was in the ratio of 100 to 254; also that agriculture was still the main resource of Norway and that, while its practice had been much intensified, the returns had not kept pace with population growth. Hence Norway needed now to import 58 per cent of her grain requirements, $33\frac{1}{3}$ per cent of her fats, and all her sugar. A. R. Nordvall (pp. 57-58) stated that, while, between 1820 and 1830, 82 per cent of all the Swedes were agricultural workers and in 1910 only 48 per cent, Sweden was nevertheless producing greater crops now; but that in spite of this, whereas formerly there was an export surplus, now about one-fourth of their food requirement was imported.

For the Allies the food situation of Japan (pp. 81-82) was indicated by Viscount K. Ishii as not serious, but only because of Japanese frugality as compared with the "magnificent luxury" of America, as Japanese food requirements were limited to the barest necessities of life and the nation's diet consisted mainly of vegetables, rice, roots, and barley. François Monod reported for France (p. 84) that French wheat production before the war barely equaled home consumption, Arthur Pollen for Great Britain (p. 91) that by weight one-fourth of all British food was imported.

ESSENTIAL ELEMENTS IN FOOD

In the section entitled "Food Utilization and Conservation" is a very suggestive article by E. V. McCollum entitled "Some Essentials to a Safe Diet" (pp. 95-102), emphasizing the significance of the two unknowns in food substances, generally referred to as vitamins. The author points out that while cereals are the cheapest energy foods, all seeds are deficient in one of these two food essentials. This, the "A" vitamin, is, however, plentiful in milk, in eggs, and in plant leaves. The "B" vitamin is absent from polished rice, from both vegetable and animal fats, from sugars and starches. Lack of the first vitamin produces eye trouble in children; deficiency in the second, beri-beri disease, the characteristic of which is general paralysis.

Here is introduced a factor of the food problem that has only been touched upon in the preceding paragraphs. The obstinate refusal of the North European peasantry to adopt our high-yield corn as a chief food

staple has been much commented on. But it appears that there is a good reason behind this instinctive aversion. The maize kernel is found, by actual experimentation with human beings, deficient in three ways as human food. Its proteids are not of satisfactory character, it lacks a sufficient amount of "A" vitamins, and it is too poor in inorganic salts. While this indictment in a general way applies to all cereals, corn alone, in particular, will not support physiological well-being in a growing animal. Moreover, it appears that their customary unvaried corn bread, salt pork, molasses diet is responsible for the fact that thousands of the working people of the American South at the end of winter suffer from pellagra, as do also the Italians, who subsist largely on polenta. If milk is used, meat can be dispensed with, hence vegetarianism is entirely feasible. But the cost of milk must go up and up as far as is necessary to preserve the dairy industry, and an adequate supply of green vegetables must be made available to the city dweller. Green vegetables because of spoilage are hazardous stock for the retailer; hence the exorbitant prices usually charged. The alternative is a resort to a bread made up of cereal with an admixture of alfalfa-leaf flour. To be sure, such a bread would be slightly green in tint and astringent in taste, but small matter that to the food enthusiasts who urge blithely that if we will only overcome our silly prejudices there is food in plenty.

THE PROBLEM OF MARKETING

A. B. Ross, under the title "The Point of Origin Plan for Marketing" (pp. 206-210), proposes a solution for this problem of green foods by the establishment of standardizing plants located at the strategic geographical points between a given producing region and its city market. He suggests that all raw produce from the farm shall pass through such plants and, under direction of an expert, be graded, prepared for the retail market, and placed in cold storage or canned whenever there is an oversupply of perishables at a particular time. Retailers' and consumers' co-operatives generally could depend on such a regional institution for all requirements of the local market, and this would do away with the erratic and expensive transshipment now characteristic of the distribution of many perishable foods.

Herbert Hoover¹¹ likewise maintains that agricultural industry must be made to pay adequate returns to the farmer and concurs in the finding that the excessively high cost of foods to city customers results from faulty transportation and the altogether disproportionate spread in price between the wholesaler and consumer. Like Ross, he finds this to be due in part to the wide distances, often, between the producing areas and their markets, which could usually be remedied; and the fact that each of the

¹¹ H. C. Hoover: Some Notes on Agricultural Readjustment and the High Cost of Living, *Saturday Evening Post*, Vol. 192, 1920, April 10, pp. 3-4, 45, 46, 49, 50.

intermediaries concerned in this faulty distribution system, wholesaler, transportation agent, commission man, cold-storage warehouser, food manufacturer, retailer, must make a separate profit on his investment; and, as each one of them conducts his business on a percentage basis, every increase in the original payment to the farmer is many times enlarged before the commodity gets to the consumer.

RELEASE OF LAND BY NATIONAL PROHIBITION

Reverting to the *Annals* articles there is one more paper of interest, that of A. C. Bigelow (pp. 191-197), "The Sheep Industry of the United States," in which it is stated that between 1900 and 1910 the acreage of land under cultivation in the United States showed a per capita decrease of 10 per cent and that production, by commodities, of butter, oats, wheat, and corn, decreased 10, 11, 15, and 21 per cent respectively per capita. On the other hand R. E. Smith¹² estimates that 3,600,000 acres devoted to corn, barley, and rye for liquor production have been released for food growing by national prohibition and that, altogether, prohibition has directly and indirectly freed some 5,000,000 acres, enough to feed 4,000,000 people. Because of high prices during the war years, he further estimates that some 25,000,000 to 35,000,000 more acres of American land, formerly waste and pasture, were brought under cultivation.

CHECKING OVERPOPULATION

It is quite distressing to proceed indefinitely in a pessimistic strain on this subject, hence the slight relief suggested by this recovery of land for food through prohibition is pleasing. And the situation is not altogether hopeless. But all the remedies proposed approach the problem from the wrong side. While it is altogether laudable to urge all possible means for increasing the food supply and procuring its better distribution, it ought to be made a first object of the nations of the world to "succeed with what they have" instead of desiring to expand indefinitely in numbers regardless of the present world provision for subsistence. In other words it should be much easier to curb overpopulation than to provide new avalanches of food.

Readers of this *Review* will therefore find of equal interest an article by J. O. P. Bland¹³ in which five books and papers of great geographic significance are reviewed, inasmuch as the contributions that Bland ana-

¹² R. E. Smith: *Thirty Million More Acres*, *Independent*, Vol. 97, 1919, pp. 292-293.

¹³ J. O. P. Bland: *Population and Food Supply*, *Edinburgh Rev.*, Vol. 227, 1918, pp. 232-252. The five publications reviewed are:

James Marchant: *Birth-Rate and Empire*, London, 1917.

The Declining Birth-Rate: Report of the National Birth-Rate Commission [of Great Britain], London, 1916.

C. K. Millard: *Population and Birth Control: An Address*. Leicester, 1917.

Adelyne More: *Fecundity Versus Civilisation*. London, 1917.

William Bateson: *Biological Fact and the Structure of Society* (Herbert Spencer Lecture, 1912). Oxford, 1912.

lyzes all emphasize the effect of the factor of population growth. In what follows the figures for birth and death rates and other vital statistics are, unless otherwise indicated, taken from this article.

Bland points out that the various panaceas that have been proposed for the amelioration of human woes recognize that the first essentials in such a program are the reduction of poverty and the elevation of standards of living among manual workers, but that, contrariwise, the proposers of such panaceas usually refuse to recognize that the fundamental cause of economic pressure is overpopulation. Any proposal for the limitation of numbers in a given national group seems to be instinctively resented and to provoke a feeling akin to race hatred. Hence, Bland says, positive checks—war, pestilence, famine—must operate. The fecundity of the human race has become adapted to these positive checks. In the Middle Ages the European birth rate was 45 per thousand, and the death rate the same; during the last century the birth rate has not been greatly reduced, but the death rate is only 14 per thousand. Hence the enormous increases in population of modern years. M. Hardy, a French scientist, is quoted to the effect that an equal distribution of the total proteids annually available in foods would give each individual only two-thirds the amount necessary for physical efficiency and that this shortage would exist even if the underfed masses of India and China were eliminated from the calculation.

POPULATIONS CANNOT INCREASE INDEFINITELY

Opposed to the obvious remedy for such conditions a number of factors operate. Because the exploitation of a virgin America, the development of transportation facilities, and industrialized mechanics permitted large increases in the population of the temperate zones during the last century with some actual increase in comfort for all, it is popularly conceived that this increase in numbers can go on indefinitely without bringing into operation the law of diminishing returns. Here it is overlooked, first of all, that the former food reservoirs are rapidly developing their own industrial civilization and increasing their populations correspondingly, so that shortly they will not produce an export surplus of food. The United States has only recently arrived at this very point; New Zealand, Australia, Chile, and Argentina will follow.

THE RACE PRESERVATION INSTINCT

A second difficulty is the instinct of race preservation and national expansion, already referred to, which has for its practical basis the militarist need for man power and the capitalistic requirement of cheap labor. In view of the war extremities then prevailing one can forgive the statement of Sir Bernard Mallet in his presidential address before the Royal Statistical Society on November 20, 1917,¹⁴ to the effect that many people see

¹⁴ Sir Bernard Mallet: *Vital Statistics As Affected by the War*, *Journ. Royal Statistical Soc.*, Vol. 81, 1918, pp. 1-36. London.

in the declining birth rate of Europe a cause for congratulation in view of the foreseen shortage in the world's food supplies, but he, even if this shortage is actually impending, which he doubts, would be unable to look with indifference on the phenomenon of the declining birth rate. "His attitude towards the general problem of population was decided by the instinct of race preservation." He might have taken heart if he had considered the record of the "degenerate" French during the war and the facts of population in New Zealand and Holland as set forth below.

RELIGIOUS TEACHINGS

The third and last difficulty in bringing about any reduction in national increase is the influence of religious teaching. "Be fruitful and multiply," "replenish the earth," "the Lord will provide" are the precepts of the Old Testament Jewish, the Confucian, and the Indian religions alike. The Chinese and Japanese ideas of ancestor worship are akin to these religious precepts in their effects on population increase. Such religious teachings may have been well enough adapted to the times when they were first promulgated, but they scarcely fit now. There will no doubt be readers of these lines whose religious susceptibilities will be offended by such attitude, but, before they take up the cudgels with the humble author or Mr. Bland or the authorities he quotes, let them consider first the apparently well-authenticated fact that the clergy of the Church of England, who continue to urge an unrestricted birth rate and who forty years ago practiced what they preached (for the birth rate of their group was above the national average), now have a birth rate near the bottom of the list, close to that of the medical profession and the teachers, who are lowest, and only one-half that of the coal miners and the agricultural laborers, who head the list!

BETTER PEOPLE NEEDED RATHER THAN MORE

The other and much more rational view is that stated by Professor Bateson, as follows: "To spread a layer of human protoplasm of the greatest possible thickness over the earth—the implied ambition of many publicists—in the light of natural knowledge is seen to be reckless folly. . . . We need not more of the fit but fewer of the unfit."

Infant mortality increases regularly in proportion to the size of the family. In China 75 to 85 per cent of all babies born die in infancy; the birth rate is 50 per thousand. If the death rate of China were reduced to the European level and there were no counteracting forces there would be 4,000,000,000 Chinese in 100 years. In Bombay, India, the infant mortality was 322 per thousand in 1911, in the same year in London it was 91 per thousand. In the following statement the first figure in each class gives the births, the second the deaths, per 1,000 married males under 55 years in England. Upper and middle class, 119:76.4; skilled workmen, 153:112.7; unskilled workmen, 213:152.5. The effect of large families is only to fill graveyards with human waste.

But, it will be urged, reduction in number of births spells race suicide, particularly since, altogether aside from chauvinistic national ideals, the reduction is greatest just in those classes that it is desirable should be perpetuated. Such is not, however, the case. In 1860 the birth rate in New Zealand was high, over 40 per thousand; in 1911 it had declined to 26 per thousand. But at the same time the death rate had been reduced to 9.5 per thousand, the lowest on record, and the natural increase due to the excess of births over deaths sufficed to double the New Zealand population in 44 years. Nevertheless the Bishop of London in 1913, having this low New Zealand birth rate brought to his attention, was constrained to utter grave warning in view of the "glorious fertility" of China and Japan. Of even greater significance to geographers is the record of Holland. In that country birth-rate restriction was made a matter of national policy on humanitarian and eugenic grounds. Between 1881 and 1910 the birth rate fell to 28 per thousand, the death rate to 12.3 per thousand, the lowest in Europe. In the last fifty years the average stature of the Dutch people has increased by 4 inches, and the physical and social status of the population has much improved. The Dutch themselves attribute this betterment of the national stock to education of the poorest and the physically unfit in regard to the evils of families unrestricted in size. Here, again, it will be hard to find any other way to "beat the Dutch."

NO PROSPECT OF DECREASE OF YELLOW AND BLACK RACES

There is, however, little doubt but that, despite the various difficulties, preventive checks on the birth rate will come to be generally applied in the near future in all temperate lands and among all European peoples. The real danger zone is in the tropical and subtropical lands inhabited and occupied by the yellow and black races. These areas are the potentially great food reservoirs of the future and the naturally complementary trade areas for the temperate lands. In exchange for their raw products we can furnish their peoples with our industrial products. But it seems to be quite well demonstrated¹⁵ that the white race cannot work, flourish, and procreate in such latitudes. Hence development of the tropics must depend on the labor of tropical native peoples.

But these peoples, blacks, Chinese, East Indians, when protected by European supervision from the positive checks of war, pestilence, and famine, tend immediately to fill up their countries to the absolute level of subsistence. In India, owing to irrigation extension and public sanitation introduced by the British, the population increased from an already crowded 287,000,000 in 1891 to 315,000,000 in 1911 without in the least improving the economic conditions of the coolie. Governor Yager¹⁶ has

¹⁵ See Griffith Taylor: *The Settlement of Tropical Australia*, *Geogr. Rev.*, Vol. 8, 1919, pp. 84-115, for a very careful and authoritative statement on this point; also the writings of Ellsworth Huntington.

¹⁶ Arthur Yager: *Overcrowded Porto Rico*, *Geogr. Rev.*, Vol. 1, 1916, pp. 211-212.

made very clear the similar effect in an American tropical possession, and a recent publication by the Department of Commerce¹⁷ supplies like facts with reference to Barbados and Jamaica. In fact, of all the West Indies, only in Cuba, where a white South European population predominates, are the standards of living reasonably high according to our measure.

The only alternatives available to combat these conditions, to prevent the tropical peoples from so completely occupying their lands (once positive checks to population growth are removed) that only a meager existence will be afforded the indigenous population and no room be available for plantation culture and export production in exchange for temperate-land manufactures, and, at the same time, to secure the toil of the natives, are: either forced labor under European supervision—virtual slavery, against which all enlightened thought rebels—or the raising of the standard of living among the black and yellow races.

THE DIFFICULT PROBLEM OF THE TROPICS

But this last and only solution is not an easy one to apply. The tropics are and must always be the land of tomorrow. What can be done one day can just as easily be done the next, for it will be just the same as that just passed; no necessity for seasonal provision for the future or old age is imposed by climate or the conditions of natural produce. Industrial and agricultural education, a living wage, and extraordinary incentives to purchase and use the comforts and recreations afforded by temperate-land devices, improvement of agriculture by better practices and introduction of labor-saving machinery, substitution of diversified production for the one-crop method that is now typical of each of the different districts, will all help toward such an end. But great problems remain to be solved. Some of the tropical areas are overpopulated, others almost altogether lack inhabitants. The people of the overcongested regions cannot well be moved to those which are thinly peopled. Waters¹⁸ recognized this difficulty on his visit to the Philippines to investigate agricultural conditions; Bowman¹⁹ likewise has called attention to the home-loving instinct which prevents the plateau dwellers of South America from forsaking their barren habitats for the plainly visible luxuriant slopes at lower levels. Nevertheless some such migration is already occurring in the spread of Chinese coolie labor and West Indian black labor to various tropical shores.

¹⁷ Garrard Harris and others: *The West Indies as an Export Field*, *Special Agents Ser. No. 141*, Bur. of Foreign and Domestic Commerce, U. S. Dept. of Commerce, Washington, D. C., 1917.

¹⁸ H. J. Waters: *The Development of the Philippine Islands*, *Geogr. Rev.*, Vol. 5, 1918, pp. 282-292; reference on p. 288.

¹⁹ Isaiah Bowman: *The Highland Dweller of Bolivia: An Anthropogeographic Interpretation*, *Bull. Geogr. Soc. of Philadelphia*, Vol. 7, 1909, p. 160.

FIVE YEARS OF THE PANAMA CANAL: AN EVALUATION*

By ROBERT M. BROWN

The Panama Canal was opened to traffic on August 15, 1914. During the three hundred years since Balboa, the advantages which would follow the completion of the project have been enumerated time and again. Some of these were obvious, such as the shortening of the sea route between New York and San Francisco, while others were more obscure and only prophetically demonstrable, such as the increased use of the Mississippi River waterway. The traffic between the eastern and the western shores of the Americas, never so large as that between the western and eastern shores of the Old World, which resulted in the building of the Suez Canal, was subject to a problematical increase under a shortened sea way, but, over and above this, facilities for the quicker movement of the navy of the United States from its Atlantic to its Pacific seaboard or vice versa were of paramount importance. In this latter argument, the canal might be considered a paying investment regardless of costs and revenues. The canal was opened for traffic a few days after the world war began. In spite of the falling off in commerce due to the war, the canal became a paying investment from the standpoint of actual earnings before the armistice was signed.

Another phase of the canal question which is most amazing is the transformation of the zone from a pestilential area of difficult and dangerous travel to a land where the death rate is less than that of some of our large cities, as well as to a land of well-paved roads and bountiful crops. Some of these results have been beyond the dreams of the most sanguine adherents of canal construction, and the history of the last few years during which the United States has been in charge of the Canal Zone is a record of remarkable achievements.

Catastrophe and disaster are still prophesied as imminent by those who believe that slides and earthquakes have not registered their maximum expression; but, while these are always possible, they appear from the records of the last few years to be fairly remote contingencies, more serviceable as propaganda against the efficiency of the canal than as actual warnings.

The following notes, taken from the annual reports of the Governor of the Panama Canal, give one a résumé of actual operations for a period of years. By means of the results so far achieved we can now test the validity of the earlier theoretical analyses of the value of the canal and gain a clearer idea of its future importance.

* For an account of the canal shortly before its completion, see J. W. Herbert: *The Panama Canal: Its Construction and Its Effect on Commerce*, *Bull. Amer. Geogr. Soc.*, Vol. 45, 1913, pp. 240-254, with map in 1:660,000.—EDIT. NOTE.

REVENUE

The tolls levied on vessels passing through the Panama Canal since the opening of the canal (August 15, 1914) to July 1, 1919, amounted to \$28,475,285.85. Of this amount a part is uncollectible, as shown below, leaving as the actual revenue of the canal from tolls the sum of \$24,810,499.11. Appropriations by Congress for canal purposes up to this time have been \$459,443,105.99. For the fiscal year ending June 30, 1919, the tolls collected reached the sum of \$6,156,118.95; and the total revenues the sum of \$6,354,016.98. The canal authorities claim a loss during the year of \$867,526.48—because of a difference between the Panama Canal rules for the measurement of the tonnage of vessels and the rules as laid down by the United States statutes—and a total loss of \$3,664,786.74 since the opening of the canal.¹ The main point of divergence in the two sets of rules has reference to the open deck cargo. The Panama Canal rules provide that on vessels carrying stores, timber, cattle, and other cargo on open deck spaces the tolls which are payable on the vessel's net tonnage shall be increased by the tonnage of space occupied by the goods on deck. This ruling was felt particularly by the lumber interests of the Pacific Coast, and upon their protest the Attorney General of the United States decided that the measurement of vessels must be in accordance with the United States rules and that tolls levied in excess at Panama are not collectible. The Panama Canal rate of \$1.20 per net ton—each 100 cubic feet of actual earning capacity—was higher, in many instances, than the National rate of \$1.25 per ton of net capacity. The difference between these two tonnage rates has (as stated above) amounted to \$3,664,786.74, which the authorities at the canal report as a loss but which under the circumstances has no potential value.

For the year ending June 30, 1918, the revenue earned was for the first time in excess of the expenses, leaving a balance in favor of the canal management of \$697,556.23. The previous year the expenses exceeded the revenue by \$979,648.90;² and to July 1, 1919, the expenses have been in excess of the revenue by \$4,618,690.75. During the last fiscal year the revenues were in excess of current expenses by \$241,822.21.³ The increase of revenue from tolls and the maximum yearly revenue which could be confidently looked for with a normal increase each year in the number of vessels using the canal depend at present on the possible number of lockages which can be permitted by the available storage capacity of the reservoirs.

VESSELS USING THE CANAL: PRESENT AND FUTURE

The average number of lockages made at all locks for each month of the fiscal year ending June 30, 1918, was 195.39, or about 6.5 through lockages

¹ *Ann. Rept. Governor of the Panama Canal for the Fiscal Year Ended June 30, 1919, Washington, D. C., pp. 22, 170, 188.*

² *Ibid.*, 1918, pp. 26, 186, 205.

³ *Ibid.*, 1919, p. 188.

er day. The greatest number of lockages made in any month occurred in May, when the Atlantic locks made 229 and the Pacific locks 225. During the year, a total of 2,130 vessels⁴ passed through the canal with an average of three lockages per station, Gatun, Pedro Miguel, and Miraflores, of 2,345 lockages.⁵ This average for the year ending June 30, 1919, fell to 2,313.⁶ The number of ships passing through the canal exceeds the number of lockages because of the possibility at times of passing more than one ship through in a single lockage.

This number of lockages did not tax severely the storage capacity of Gatun Lake. In general it is planned to have this lake at or near its maximum allowable elevation, plus 87 feet, at the beginning of the dry season, which roughly includes the first four months of the calendar year. During the fiscal year ending June 30, 1918, the elevation of the lake was plus 87.06 feet at the beginning of January, and this level had not been lowered appreciably on February 1. The minimum elevation for the year occurred on April 21 at plus 84.52 feet.⁷ For the year ending June 30, 1919, the maximum elevation occurred in January, when the water stood at plus 85.56. The minimum elevation, in April, was 84.15 feet.⁸ Practically all the water above plus 80 feet is available for use. The bottom of the canal through the lake is 40 feet above sea level, and the lowering of the lake below plus 40 feet would reduce the depth of water for floatments below 40 feet. It was estimated that the water in the lake not used during the dry season of 1918—that is the water between plus 84.52 feet and plus 80 feet—even with allowances for proportionate depletion for other things than lockages was sufficient to provide for 15 complete canal lockages daily instead of the 5.5 daily average which was actually made. A large part of the water depletion as shown below is fed to the hydro-electric generating plant; and it was further estimated that by conserving the amount furnished for this purpose the upper limit of lockages might be increased to 36 a day.

The maintenance of the water level of Gatun Lake above plus 80 feet depends on the available supply yielded by the hydrographic basin, the consumption for canal purposes, the depletion other than consumption, and the further possibilities for water storage.

The rainfall over the Gatun watershed has averaged for thirteen years 26.45 inches a year.⁹ The three driest months—January, February, and March—have a monthly average of 2.8 inches. Of the waters of the lake lost or consumed during the fiscal year, about 69 per cent went in spillway discharge. During nine months of the year, the water is in excess of the demands for all purposes and has to be freed; it is only during the dry period of three and a half months that the rainfall is insufficient to meet the needs of the canal and the auxiliary plants. Thus a storage capacity in the lake is necessary, and the footage between plus 80 feet and plus 87 feet.

⁴ *Ann. Rept. Governor of the Panama Canal for the Fiscal Year Ended June 30, 1918*, Washington, D. C., p. 135, 137.

⁵ *Ibid.*, 1918, p. 44.

⁶ *Ibid.*, 1919, p. 42.

⁷ *Ibid.*, 1918, p. 45.

⁸ *Ibid.*, 1919, p. 43.

⁹ *Ibid.*, 1918, p. 86.

until other arrangements are made, must tide over until the rain becomes heavy. No immediate need of extra storage seems imminent.

The consumption of water for lockages during a year is only 7 per cent of the total lost or used. Next to the spillway discharges from the excessive rains (69 per cent), the hydro-electric station uses the greatest amount of water, 14 per cent of the total. About 9 per cent is lost by evaporation, and the remaining 1 per cent is divided among leakages, transfers, and pumping.¹⁰ Altogether about 78 per cent of the water flowing out of the Gatun watershed during the last fiscal year was lost, that is was not used for any purposes relating to the canal; only 22 per cent was actually consumed on the plant projects. There is water enough for additional storage. In case lockages during any dry season drain the lake level to plus 80 feet, it is the plan to feed less to the hydro-electric plant and thereby save water in storage for actual ship floatments. The maintenance engineer of the canal is of the opinion that during an average year it will be possible to operate the hydro-electric station at full projected capacity, using 3,260 cubic feet of water per second, and take care of about 21 complete canal lockages daily throughout the dry season without utilizing additional storage. With any increase in this estimate of daily lockages, water will have to be drawn from the allowance of the power plant. "With 36 canal lockages daily during the driest year of record, it will be necessary to cut the water used for power development to about 900 cubic feet per second throughout the dry-season months, which is sufficient to operate the hydro station at about 25 per cent of its full projected capacity."¹¹ The future increase of the canal traffic up to this optimum will have to be met in one of two ways: either by using the auxiliary steam plant in place of the hydro-electric station during the dry season so as to conserve water or by finding a way to impound more of the water of the wet season which is lost by spillway discharges.

During the year ending June 30, 1919, about 40 per cent of the total number of vessels passing through the canal were from the United States; 30 per cent were British; 6 per cent Norwegian; 5 per cent French; and 4.5 per cent Chilean; the rest were mainly Japanese, Danish, and Peruvian. The gross tonnage was 7,876,703.¹² For 1914 the gross tonnage passing through the Suez Canal was 26,866,340.

SLIDES

The canal up to July 1, 1919, has been closed by obstructions due to slides 242 days out of a possible 1,537 days. Of this time 210 days were a consecutive period lasting from September 18, 1915, to April 15, 1916. Of the entire length of the canal, about 35 miles between mean tide levels, only the portion between the Pedro Miguel locks, the highest on the Pacific side,

¹⁰ *Ann. Rept. Governor of the Panama Canal for the Fiscal Year Ended June 30, 1918*, Washington, D. C., p. 45.

¹¹ *Ibid.*, 1918, p. 93.

¹² *Ibid.*, 1919, pp. 119, 120.

and Bas Obispo, near Gatun Lake, is subject to slides. This cut across the highest part of the Isthmus, formerly called Culebra Cut and now officially called the Gaillard Cut after the late David Du Bose Gaillard, one of the leading engineers of the canal, passes through rock for $8\frac{3}{4}$ miles; and of the Gaillard Cut only about 2,800 feet at Culebra Hill and 2,000 feet at Bearachá Hill have been troublesome slide locations. Two and one-half per cent of the entire length of the canal, therefore, or about ten per cent of the Gaillard Cut constitutes the length affected by slides. The slides caused by the slipping down of loosened earth on steep slopes are small in extent and relatively insignificant; the more common type of slides in the Gaillard Cut have apparently resulted from the unbalancing of the established equilibrium in digging the canal. The lateral support of the hills on both sides of the canal in the Culebra district was, considering the peculiar nature of the native rocks, more important than had been determined in the original specifications. When this support was removed, the weight of the hills on each side of the Gaillard Cut in the Culebra district was sufficient to cause a movement outward from the hills into the canal where the pressure had been removed. Coincident with the lateral movement of the banks into the canal an elevation of the bottom of the canal, due probably to the same cause, occurred. Thus on September 18, 1915, the date of the beginning of the big slide, both banks began a strong movement into the canal prism; and on the next day an island, the result of an upheaval, appeared in the canal. At its greatest height, the obstruction in the canal, during this slide, covered a distance of 255 feet of canal length, and the débris stood 65 feet above the mean water level in the canal.¹³

It is not so much the purpose here to enter into the details of slide causes as to state, as fairly as can be determined, the conditions which may affect the use of the canal as a waterway. The closing of the passage for 232 days in a single year so soon after the opening of the canal tended to destroy confidence in a sure and safe passage through it. The wide publicity given to the slides in papers and magazines emphasized the accident as a recurrent feature rather than as an unusual phenomenon. During November, 1915, at the request of the President of the United States, a committee of the National Academy of Sciences was appointed to consider the possibilities of controlling the slides. The final paragraph of their preliminary report is quoted:¹⁴

The committee looks to the future of the canal with confidence. It is not unmindful of the labor necessary to deal with the present slides; and it realizes that slides may require a considerable, but not an unreasonably large maintenance charge upon the canal for a number of years; it also realizes that trouble in the Culebra district may possibly again close the canal. Nevertheless, the committee firmly believes that, after the present difficulties have been overcome, navigation through the canal is not likely again to be

¹³ *Ann. Rept. Governor of the Panama Canal for the Fiscal Year Ended June 30, 1916*, Washington, D. C., 1916, p. 32.

¹⁴ *Ibid.*, 1916, p. 598.

seriously interrupted. There is absolutely no justification for the statement that traffic will be repeatedly interrupted during long periods for years to come. The canal will serve the great purpose for which it was constructed, and the realization of that purpose in the near future is assured.

The committee bases this confident conclusion of their investigations on the fact that the soft rock which has been the primary cause of the slide is limited in extent and that the harder rock has displayed no tendency to move. Since their investigations, the history of slides in the canal has been in accord with these findings.

At the end of the next fiscal year, June 30, 1917, in summing up the report on slides, it is found that the Cucaracha slide became active late in August, 1916, and traffic was suspended through the canal for a period of eight days ending September 7; and that the Culebra slide was fairly active during the year but was not sufficiently so to close the canal except for two days, January 10 and 11, 1917.

At the end of the fiscal year ending June 30, 1918, the Cucaracha slide is reported to have been at no time a menace to navigation, and the Culebra slide, although it continued its action, did not at any time close the channel or delay shipping. There is a promise of making this district permanently free from slides by a small (in comparison with what has been removed) additional amount of earth removal. During this year another unstable region near West Culebra menaced navigation, but the trouble was discovered and remedied before becoming serious. No "difficulty in maintaining full width and depth of the channel in the Culebra slide region"¹⁵ is the report for the year ending June 30, 1919.

In concluding this survey of the slides, it is safe to assert that accidents to the canal from this cause may be confidently expected to be fewer and fewer. It would be fortunate indeed if no further blockage of the waterway by slides were to be recorded; but this is perhaps too much to hope for. The canal is not yet out of danger from this cause of obstruction; but it is apparently out of danger of a prolonged period of closing.

EARTHQUAKES

The entire Isthmus is in an area subject to seismic disturbances, and the threat of a severe earthquake hangs over the whole Canal Zone. It is impossible to forecast the expectable damage in case of a severe earth shake. The records during the last few years demonstrate little more than the fact that earth shakes are common. For the year ending June 30, 1916, there were recorded 59 tremors, practically all of them of local origin. The heaviest did considerable damage to the wharf of the United Fruit Company at Bocas del Toro. This shock was recorded as V on the Rossi-Fore scale of I to X and in translation would read "shock of moderate intensity." During the following year 32 tremors were recorded, of which seven were of distant origin, the epicenters ranging more than 1,000 miles away. The

¹⁵ *Ann. Rept. Governor of the Panama Canal for the Fiscal Year Ended June 30, 1919*, Washington, D.C., p. 15.

heaviest shock recorded had an intensity of IV, which is translated as 'feeble.' For the year ending June 30, 1918, 30 disturbances were recorded, and the heaviest shock had an intensity of III (very feeble). For the next year, 46 disturbances were noted, all slight tremors from shocks of distant origin.

SANITATION

The canal in its future possibilities must render an almost unbroken passageway not only free from danger of a physical nature but also free from the danger of encountering contagious diseases. The work of the Health Department, therefore, is as necessary and must be as effective as that of the Engineer of Maintenance. The achievement of this sanitary department is a notable one, and a traveler may be assured of a safe transit of the Canal Zone so far as tropical diseases are concerned. The French kept no record of their sick rate during the years from 1881 to 1889, but it has been estimated at one-third of their force, or 333 per 1,000. The American rate was 23 per 1,000 per day during the ten years of construction with a force of 39,000 men. During the same period the death rate among employees was 17 per 1,000; which made about 663 deaths per year. The French rate was 200 per 1,000. In 1906, when the malaria rate was the highest, 821 persons out of every 1,000 were admitted to the hospitals suffering with this disease. In 1913 this rate had been reduced to 76. In 1916 the rate was 34; in 1917, 13.47; and in 1918, 20 per 1,000. The death rate for the year ending June 30, 1916, from all causes was 23.53 per 1,000; for the next year 23.46; and the next 22.21; and for the year 1918-1919 it was 20.44. When it is considered that the death rate in the United States is about 16 per 1,000 (ranging from 22 in cities to 14 in rural districts), one feels safe in asserting that danger from diseases in the Canal Zone area has been reduced to a minimum. The labor expended in accomplishing this wonderful result has been large, and it is only maintained by vigilance and untiring care. During 1918, for instance, bubonic plague raged along the South American coast from Valparaiso northward; yellow fever was spreading through Guayaquil and the surrounding country; smallpox broke out in Bluefields, Nicaragua, and in Cartagena, Colombia; and the plague was rampant in Venezuela. All these places were points of call for vessels bound through the canal, yet no case of plague, smallpox, or yellow fever was reported in the Canal Zone. The quarantine stations protecting the entrances to the canal are sufficient safeguards against all these conditions. The tables of quarantine service show for the ports of Panama and Colon for 1919 that 174,194 persons were inspected, 6,882 persons vaccinated, and 17,254 persons held in quarantine. The conclusion of the matter appears to be that there is some danger of contracting disease in the passage to the canal (increasing in proportion to the number of calls the vessel makes) and that there is very little danger from contagious diseases in the canal district. It is an evidence of the efficiency of this service that

the influenza, which swept the world during the last months of 1918, was little felt in the Canal Zone; this was due probably to the special quarantine against influenza.

ECONOMIC OPPORTUNITIES OF THE CANAL ZONE

With the eradication of the dreaded tropical diseases from the Isthmus, the Canal Zone and its neighborhood should attract settlers; particularly as the opportunities for raising tropical products appear alluring. During 1917 Panama City alone exported bananas to the value of two and a half million dollars; coconuts to the value of three-fourths of a million; balata, half a million; hides, a third of a million; and many other native products in smaller values.

The assets in the Republic of Panama may be briefly summarized:

(1) Topography. There is within a short distance a range of altitudes which will furnish resorts for persons not accustomed to the tropical climate. The land may be considered as about one-third semi-tropical (altitudes ranging from 2,000 to 6,000 feet) and about two-thirds tropical. It is estimated that there are about 3,000,000 acres of land above 3,000 feet which, when made accessible by good roads, will be suitable for colonizers of the white race.

(2) Production. The yield of coconuts, ivory nuts, balata, bananas, and native woods is far short of the possibilities. Verner¹⁶ states that in Panama there are 2,000 square miles of coconut lands capable of sustaining 100,000,000 trees yielding a yearly product worth \$200,000,000; that the yield of ivory from wild palms is far below the available, and cultivation would increase the output thirty fold; and that there are 5,000,000 acres suitable for the cultivation of bananas which would yield at a conservative estimate \$400,000,000 as against \$2,000,000 in 1917. Whether or not such estimates are easier on paper than on the Isthmus, there appears to be good ground for considering an immediate increase in the exports likely. Shipments would of course be a relatively simple matter.

It is not surprising that in an area so advantageous for crop production the supply department of the Canal Zone is reducing the dependence of the population upon outside sources for foodstuffs. During recent years, it has been possible to supply the inhabitants and the steamships passing through the canal with beef and pork products without importations of this staple. Chicken and dairy farms are maintained. Under the control of the supply department, there are thirteen plantations which have provided a sufficient quantity of fruits and vegetables for local consumption.

Altogether, the people of the United States can look to the achievements at Panama with pride. Many of the lines of endeavor here brought to a successful fruition are examples of skillful management and trusteeship that have been wrought without the aid of previous experience. The workers have in these lines blazed a new trail for the nations of the earth.

¹⁶ S. P. Verner: *Panama—Past, Present, and Future*, *Bull. Pan Amer. Union*, Vol. 48, 1919, pp. 125-144, Washington, D. C.

THE NATURAL REGIONS OF THE BALKAN PENINSULA (AFTER CVIJIĆ)

[With separate map, Pl. II, facing p. 204.]

The Balkan Peninsula lies at a meeting point of three of the great world regions—Central Europe, the Eurasiatic steppe, and the Mediterranean. The conformation of the peninsula is such that it is to a considerable degree open to the penetration of influences and the movements of population from all three regions. Within the peninsula the course of these influences and movements is directed and restricted by barriers that divide the peninsula into a certain number of natural regions. The definition of these natural regions forms the groundwork of Cvijić's exposition of the human geography of the peninsula in his recent great work "*La Péninsule Balkanique*."¹ The accompanying map (Pl. II) attempts to interpret this definition cartographically.

THE PHYSICAL BASIS OF THE NATURAL REGIONS

The Hellenic portion of the peninsula, deeply indented into headlands and gulfs pointing southeast towards Asia Minor, is united to the Mediterranean shores of that region by the island-sprinkled Aegean, one of the most friendly seas of the globe. In comparison the Black Sea shores are little indented, but Pontic influences travel also by landways round the sea, by the arid Anatolian steppes, and the narrow straits—sunken river valleys only—and Constantinople, or via the South Russian steppe. The northern frontier of the peninsula west of the Carpatho-Balkan arc is likewise open. The Danube and its tributaries, of which a convergence on Belgrade is noteworthy, give access to Central and to Western Europe. Within restricted limits the Adriatic has played something of the rôle of the Aegean. Great longitudinal depressions traversing the peninsula from northwest to southeast carry peripheral influences inward. To a less degree passes and transverse valleys afford west-east lines of movement. Between these depressions and transverse roads are the vast mountain massifs which separate the major natural regions of the peninsula while themselves constituting regions isolated and individualized. In the words of Cvijić the functions of the two sets of features are respectively "union and penetration" and "isolation and separation." These morphological features, and not the human elements integral in the geographical region proper, constitute the initial basis of the delimitation into natural regions. Because of the broken history of the peninsula, which in turn is related in large meas-

¹ Jovan Cvijić: *La Péninsule Balkanique: Géographie humaine*. viii and 528 pp.; maps, diagrs., illls. Armand Colin, Paris, 1918. 17 frs. 10 x 6½ inches.

ure to these characters of union and penetration, isolation and separation, ethnic and social differentiation—human adjustment to the great natural regions—is incomplete and imperfect. It may be remarked that the distribution of one great aspect of human geography, “psychic character,” involving many other characters than the geographic, is separately treated by Cvijić in the second part of the volume.

The Aegean Region

THE HELLENIC REGION

The most fundamental division of the Balkan Peninsula is into a continental and a peninsular area, the Continental Block and the Aegean Region. The Hellenic Region (1 on map, Pl. II), opening onto the Aegean, turns its back on the Continental Block. Morphological separation is reinforced by climate and its correlative circumstances (for the climatic zones, see map, Fig. 1). Greece, with its rainless summers and *maquis* vegetation, is the typical Mediterranean country. Cultivation, restricted by areal limitations, is “in miniature.” The population is turned seaward, where opportunities for fishing, navigation, and trade are unrivaled. In contrast with the essentially rural and agricultural Continental Block, the Hellenic Region is a land of particularism and city life.

THE THRACO-MACEDONIAN LITTORAL TRANSITION REGION

Certain characteristics of the Hellenic coast lands are displayed on the Thraco-Macedonian shores of the Aegean, a transition region (2) between the Continental Block and the Aegean Region. The climate is less distinctly Mediterranean; some rain falls in summer, the winters are more severe, the cornfields are larger, and the olive is less prominent in the landscape. The valleys of numerous watercourses give access to the interior and invite a different mode of life. The Thraco-Macedonian littoral has been especially the theater of Byzantine civilization, with its center at Constantinople. The transition character of the region is reflected in the population by their maintenance of distinctive traits. Whereas the highly individualized manner of life in the Hellenic peninsula has Hellenized Slav intruders, Slavs and Greeks remain side by side unassimilated in the Thraco-Macedonian littoral.

The Continental Block

THE LOWER DANUBIAN PLATEAU

The Continental Block falls into three major natural regions: Eastern, or Balkan; Central, or Morava-Vardar; Western, or Pindo-Dinaric. The

² Discussed by Miss M. I. Newbigin in “The Problem of the South Slavs (Yugoslavs),” *Scottish Geogr. Mag.*, Vol. 35, 1919, pp. 1-5.

Balkans, which continue the mountain arc of the Carpathians, and the Rhodopes together cut off the portion of the peninsula opening eastward. The Balkans separate a region of Mediterranean drainage from a region draining to the Danube and on the open road to Russia and the steppes. Here, on the Lower Danubian Plateau (3), is a distinct impress of the steppe. The climate is of continental extremes; the loess-covered slopes, exhibiting a uniformity rare in the peninsula, are of a wonderful fertility, but the wheat harvests fluctuate seriously under the liability to summer drought. Migrations from the Asiatic steppes to the plateau have had a special significance. Hither, following Slav invaders, came the Ugro-Finnish Bulgars, who fused with the Slavs, forming the basis of the present Bulgar people. They brought with them a military organization foreign to the Slavic tribes; the well-defined region offered favorable conditions for the establishment of a state, and here—towards the end of the eighth century—was formed the first Yugo-Slav state of the peninsula.

Between the Lower Danubian Plateau and the southern division of the Balkan Region relations have been close. Except in the central part the Balkan Range presents no special difficulties to movement. There are numerous passes by which the Bulgars have penetrated into Thrace and by which inversely Turkish peoples and dominion have traveled north. The complete submission of Bulgar to Turkish power was proportionate to the easy reach of Constantinople and the agricultural organization of the region. But individuality of civilization is not less marked. The Balkans figure as a part of the boundary between the two great civilizations—patriarchal and Byzantine—of the Continental Block, and psychic differences between the populations are very marked.³

THE MARITSA BASIN

The second division of the Balkan Region, the Maritsa Basin (4), lying between the Balkans and the Rhodopes, is a natural unit of another order. A more diversified relief and a climate where steppe and Mediterranean influences mingle create an agricultural region whose resources—they include wheat, maize, tobacco, peppers, rice, vine, mulberry, fruit trees—are far more varied than those of the Lower Danubian Plateau. They contribute to the formation of the most complete geographic unit of the peninsula. In contrast to the Lower Danubian Plateau the Maritsa Basin is thoroughly Byzantine (with modifications through Turco-Oriental influences), for there is no hindrance to the spread of influence from Constantinople.

The Sub-Balkan Depression (4a), a series of small tectonic basins, is a minor unit whose affiliations are more particularly with the Maritsa Basin.

³ See the map "Zones de civilisation," 1:6,000,000, Pl. II in Cvijić's volume, facing p. 100—the same map in color and on a larger scale, 1:3,000,000, in the *Geogr. Rev.*, Vol. 5, 1918, Pl. V—and the map "Types et variétés psychiques des Yougoslaves," 1:3,000,000, at the end of the volume.

THE UPPER ISKER BASIN REGION

Farther west, between the Balkans and the Rhodopes, is a region (5) which includes the Upper Isker basin and the watershed traversed by the Belgrade-Constantinople railroad. Apart from small cultivated basins, it is an elevated, deforested country, poor in resources.

UNITY OF THE MORAVA-VARDAR REGION

The Central, or Morava-Vardar, Region derives its unity from the great longitudinal furrow that traverses it from northwest to southeast. This unity is expressed in the historical tendency for a single state to control the entire furrow. The medieval Slav states pressed southward; the Turk followed in the inverse direction; and we now have the present-day efforts of Serbia to reach Saloniki. But the furrow has a double outlook; characters of isolation and separation intervene, and three divisions of the region may be recognized.

THE MORAVA, OR SHUMADIYA, REGION

The Morava, or Shumadiya, Region (6) north of Nish is a well-defined morphological unit. A terraced plateau sloping towards the Danube, it corresponds in effect with the southern limit of the Neogene Pannonic lake. Comparatively gentle contours, a fertile lacustrine soil, a climate of somewhat modified Central European type, with abundant rain and a particularly long autumn, create a region admirably adapted to the agricultural predilections of its inhabitants. The Shumadiya is the plum country and also the maize and pig-raising country *par excellence* of the peninsula. The opening up of this forested region began comparatively late, chiefly through the Serbs who sought refuge there in the course of the migrations provoked during the period of Turkish rule.⁴ Far from Constantinople and in close touch with the countries beyond the Danube, the Shumadiya not unnaturally became the center whence sprang the Serb renaissance.

Closely similar to the Morava Region is the country to the west, Bosnia (6a), which may be considered either as an extension of the Shumadiya or as the Pannonic part of the Dinaric Region.

THE CENTRAL, OR RASHKA, REGION

South of Nish is an elevated region of morphological complexity whence there is drainage to three seas. The distinguishing feature of this region is the series of tectonic basins in which, and not along crest lines, lie the chief watersheds. This peculiarity greatly facilitates communication, and several routes converge on the region: Nish and Skoplye in particular are

⁴ See the note on "The Internal Migrations Underlying the Present Distribution of the Serbo-Croats," *Geogr. Rev.*, Vol. 5, 1918, pp. 418-419.

nodal points. The basins with their former lake floors are fertile, the encompassing mountains support fine pastures, and the region is further distinguished by its mineral wealth. This is Rashka, "Old Serbia" (7), center of the ancient Serbian state.

THE VARDAR, OR MACEDONIAN, REGION

From the morphological point of view there is no marked distinction between the central and the southern division of the Morava-Vardar Region. Distinction lies in the extent to which the southern division, the Vardar, or Macedonian, Region (8), has been influenced from the Aegean, an influence that, indeed, is already apparent in the climate and productions of the Skoplye basin. There is a marked difference, however, between the Vardar and Struma basins (8b) and the Macedonian lake region (8a). The latter elevated country rather resembles the central region in the products of its cultivated basins and its pastoral pursuits. Placed between two littorals supporting winter pasturage, the mountains of western Macedonia are the great domain of *transhumance*.⁵

THE DINARIC REGION

The Western, or Pindo-Dinaric, Region, is delimited by a line of depressions running southward from the basin of Laibach (Lyublyana) to the Gulf of Arta. Unlike the Morava-Vardar Region or the Maritsa Basin the Pindo-Dinaric Region is lacking in a unifying center or centers. Even the cultivable basins (*polye*) of the karst are of insignificant extent. Yet in the Dinaric, or northern, section (9), from Karlovats to Scutari, the physical and psychic type of the population, ethnically the purest of the peninsula, and the language are almost uniform; while from Carniola to eastern Montenegro the same Alpine house type persists. This is primarily a reflection of the unity of the pastoral life of the mountains, which has been greatly facilitated by the absence of deep transverse valleys. On the other hand there is a distinct break between the *planina*, or mountain plateaus, and the *primorye*, or littoral, permeated by Mediterranean influences and looking towards western Europe, especially Italy. These two zones are separated by the barren *zagora*, the poorest country of the peninsula, lacking alike the maritime resources of the littoral and the pastures and forests of the *planina*.

THE PINDUS REGION

In the Pindus Region (10), encompassing Albania and Epirus, the factors of isolation and separation are most highly developed. Mountains on

⁵ On *transhumance* see the notes entitled "Illustrations of Seasonal Migration from Switzerland and the Dinaric Countries" and "The Geography of the Waldensian Valleys in the Italian Alps," *Geogr. Rev.*, respectively Vol. 6, 1918, pp. 73-74, and Vol. 7, 1919, pp. 265-266.

the east, delta and lagoon shore and marshy coastal plain on the west, isolate the region as a whole, while it is divided in itself by the existence of deep transverse valleys. This is a contributing cause to the intensity of

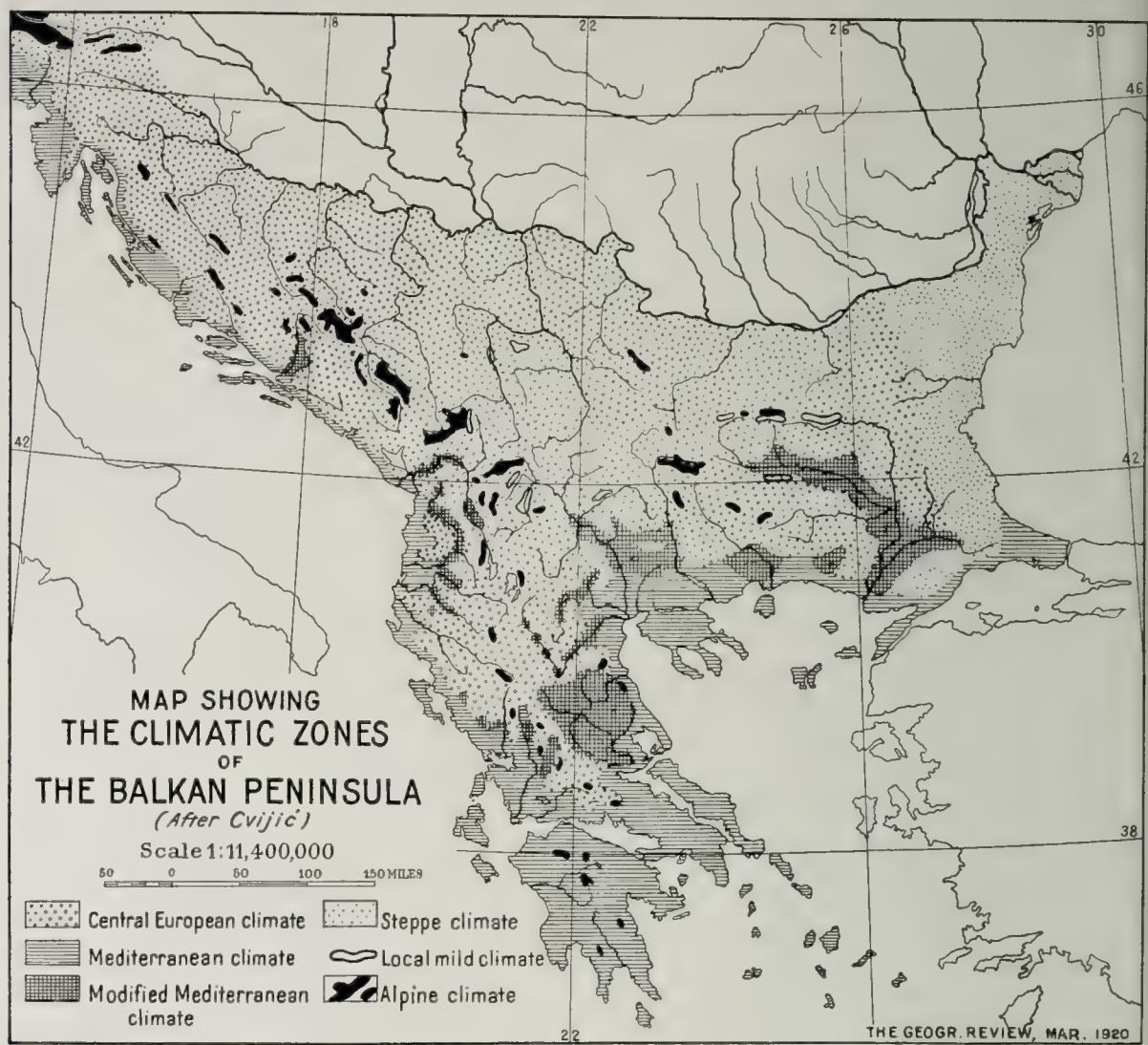


FIG. 1

tribal life and to the general backwardness of the region. The country is well provided with forests, meadows, and upland pastures; it is, in fact, much better endowed with natural resources than is commonly imagined.

MAP SHOWING
THE NATURAL REGIONS
OF
THE BALKAN PENINSULA

(Based on Cvijić's "La Péninsule Balkanique")
Scale 1:5,600,000

- I Aegean Region
- II Continental-Block
 - A Eastern, or Balkan, Region
 - 1 Hellenic Region
 - 2 Thraco-Macedonian Littoral
 - 3 Lower Danubian Plateau
 - 4 Maritsa Basin
 - 4a Sub-Balkan Depression
 - 5 Upper Isker Basin Region
 - B Central, or Morava-Vardar, Region
 - 6 Morava, or Shumadiya, Region
 - 6a Bosnian Sub-Region
 - 7 Central, or Raska, Region
 - 8 Vardar, or Macedonian, Region
 - 8a Macedonian Lake Sub-Region
 - 8b Lower Vardar Sub-Region
 - C. Western, or Pindo-Dinaric, Region
 - 9 Dinaric Region
 - 10 Pindus Region

Elevations
[Symbol] > 1500 meters [Symbol] 200-500 meters
[Symbol] 500-1000 " [Symbol] < 200 "
[Symbol] plains, irrespective of elevation



MACKINDER'S 'WORLD ISLAND' AND ITS AMERICAN "SATELLITE"

By CHARLES REDWAY DRYER

Mackinder's "Democratic Ideals and Reality," sketched, supplemented, and pruned by Professor Teggart in a recent number¹ of the *Review*, seems to justify the comment made by a Scotch geographer on the appearance of his "Geographical Pivot of History:"² "Mr. Mackinder's power of generalization is something positively uncanny." Now he has found the master key to history in the age-long struggle between the barbarous "Heartland" and the civilized coastlands of the "World Island." In dealing with conceptions of such scope and portent, perhaps it is not strange that he has failed to see the real significance of one factor, and that is America. He refers to it as "a certain pair of peninsulas . . . for practical purposes insular rather than peninsular" and classes them with Australia as "merely satellites of the old continent." He sees North America as lying off the great World Promontory which ends at the Cape of Good Hope and as analogous to the island of Crete off the Hellenic peninsula and Britain off the Latin peninsula.³ Disregarding the strain to which such a view subjects the imagination and the map, it seems to miss the real geographical significance of America.

AMERICA AS THE WORLD RING

The ancient and medieval geographers thought that the *oecumene*, or habitable world, formed one continuous land mass extending from Spain to China. Columbus incidentally upset this doctrine and opened the way to the discovery that there is a second *oecumene*, also forming one continuous land mass, 2,000 miles longer than the first but extending in a transverse direction. It is true that the New World has but half the area of the Old World, but its area is not so important as its form and position. On a flat surface it is geometrically impossible to represent a slightly skewed bar as surrounding anything, but on a spheroidal surface this is not so absurd. America is not an island in any such sense as Australia is. It forms an unbroken bar of land extending from one polar ocean to the other and lying between the European Coastland and the Monsoon Coastland of the World Island. The fact that a bar is slender midway of its length does not prevent its being a bar. Whether a ship sails from the World Island in a westerly or an easterly direction, it will come up against

¹ F. J. Teggart: *Geography As an Aid to Statecraft*, *Geogr. Rev.*, Vol. 8, 1919, pp. 227-242.

² *Geogr. Journ.*, Vol. 23, 1904, pp. 422-444.

³ H. J. Mackinder: *Democratic Ideals and Reality: A Study in the Politics of Reconstruction*, New York, 1919, pp. 80, 82, 83.

the bar, as Columbus did. Thus in effect America, with the Arctic ice fields and the Antarctic land and ice, forms a ring which almost surrounds and encloses the World Island. If a map is drawn on Mollweide's projection with the marginal meridian at longitude 100° W. and if South America is moved thirty degrees to the west (Fig. 1), the World Island appears at the center surrounded by the ring fence of America at the margin. There is only one passable gap, and that was found first by Magellan four hundred years ago. Men, money, and courage have been lavishly expended in vain to force a "northwest passage" through this ring. The Panama Canal



FIG. 1—The World Island and the World Ring.

To Mackinder's "World Island," consisting of the Old World, must be added another great geographical feature to be reckoned with in human history, the "World Ring," or America. This conception becomes clear if a map of the world is drawn, as above, on Mollweide's projection with 80° E. as the central meridian but South America shifted 30° west of its true position—a legitimate device, as it does not alter the essential relation of the New World to the Old.

is an artificial gap which may be passable or not according to the will and power of its guardians. So to the great geographical feature to be reckoned with in human history, the World Island, must be added a second, the World Ring.

To the maker of diagrams license is granted to sacrifice everything necessary to make his one point clear, but he should beware of teaching unnecessary error. Mackinder's diagrams on pages 84 and 88 of his book seem open to this criticism. In attempting to show diagrammatically the relative areas and populations of the World Island and its satellites, he draws a large circle for the island and proportionately smaller circles for the satellites; but he places the satellite circles around the larger one in their relative positions, which is going farther than the avowed purpose of the diagrams allows. North America and South America appear as two widely separated circles; but this implies an unjustifiable error. If the

Americas were shown as a long bar across the page on each side, with circles between them, the diagram would involve only a pardonable sacrifice of the truth. In the Mollweide map herewith the only liberty taken with facts is the straightening of the skew in the position of the two Americas, and the map is diagrammatic in that respect only. Otherwise it is in exact accordance with the facts. This departure places the South American segment of the World Ring in line with the North American segment, a little farther from the World Island on one side and a little nearer to it on the other, and in no way modifies the essential fact of the existence of the ring.

ITS POTENTIALITIES

The American ring fence, merely as a passive, physical barrier, counts for much. But it is several thousand miles wide, and its natural resources make it a home for men not inferior to the best parts of the World Island. Even if manned by only 200,000,000 capable people, it is a world factor not to be overlooked. In the past America has been content to play the part of a remote satellite of the World Island, but recent events indicate other possibilities for the future. It would require a prophet with truly divine inspiration to forecast her rôle in the drama of mankind. Some general considerations which will influence it are obvious. Her relations will necessarily be much closer with the peoples of the coastlands of the World Island than with those of the Heartland and closer with the European Coastland peoples than with the Monsoon Coastland peoples. This is not only on account of lesser and greater distance but still more on account of ties of consanguinity and culture. America may protect the European Coastland from attack in the rear and may provide an open road for the transfer of reinforcements between it and the Monsoon Coastland. America has no barbarous Heartland, and the people of her more densely populated coastlands are united to a degree unknown in the Old World. In their hands her resources fit her to become a productive and secure base for sea power and man power. American lands and peoples may be sufficient to turn the scale in favor of the powers with which they are allied. If and when the real Armageddon comes, even if the forces of the Old World Heartland are organized from Germany to Japan, the children of light may find themselves backed by an outer line of defense which the powers of darkness will be unable to break.

It is hoped that sometime Sir H. J. Mackinder will use his brilliant powers to make a really world-wide generalization and give us a map which will show the lands and peoples of the globe in the relations not of the past but of the future.

GEOGRAPHICAL RECORD

AMERICAN GEOGRAPHICAL SOCIETY

Meetings of March. A semi-monthly meeting of the American Geographical Society was held on Tuesday evening, March 9, at the Engineering Societies' Building, 29 West Thirty-ninth Street. President Greenough presided. The lecturer of the evening was Professor Henry E. Crampton of Columbia University, curator of invertebrate zoölogy at the American Museum of Natural History; he delivered an address entitled "Among the Islands of the South Seas" which dealt with his expeditions to the South Pacific in the years 1906 to 1909. On March 23 a monthly meeting of the Society was held. President Greenough presided. He submitted the names of 12 candidates for Fellowship, each of whom had been approved by the Council, and they were confirmed as Fellows of the Society. Thereupon Dr. Fay-Cooper Cole, the anthropologist of the Field Museum of Natural History, Chicago, delivered an address entitled "Glimpses of Japan."

NORTH AMERICA

The Country's Health. Geographers on the one hand and public health officials on the other are more and more realizing the intimate relation between geography and health. Therefore geographers ought to know of the little bulletin which has recently been inaugurated by the Metropolitan Life Insurance Company of New York. It bears the dry title of *Statistical Bulletin*, but "The Nation's Health" would better express its distinctly interesting character. The records of the company furnish a general survey of the health of the country as a whole. On this basis the editor of the bulletin prepares little articles stating the outstanding facts for the preceding month. For example, a page of the February bulletin is devoted to the difference between the influenza epidemic of 1920 and the far worse epidemic of 1918. Then a half page discusses the unusually low mortality during January, 1920. This favorable condition is rather surprising since the prolonged low temperature, at least in the East, would lead to the expectation of a high death rate. Perhaps the widespread cover of snow and the consequent freedom of the air from dust offers the explanation. Other articles castigate us for allowing such things as epidemics of diphtheria and explain the favorable decline which tuberculosis continues to show. A particularly interesting table shows the extent by which the average life would be lengthened if we could stamp out tuberculosis. For example, if there were no tuberculosis, the average boy 10 to 15 years of age would have the prospect of living about four years longer than he has at present. This, like many other conditions of health, has a geographical bearing, for one of the chief cures for tuberculosis is the right kind of air. If future issues are as interesting as the first ones the *Statistical Bulletin* is well worth keeping in touch with.

ELLSWORTH HUNTINGTON

Weather and the Winter-Wheat Yield in Ohio. A recent number of the *Monthly Weather Review* (December, 1919, pp. 841-847) contains the results of a statistical study, by T. A. Blair, of the weather factors affecting the yield of winter wheat in Ohio. Because of the difficulty of securing extensive data for other elements, it is necessary to deal chiefly with temperature and precipitation values. Because of the relatively large and well-distributed rainfall of Ohio, temperature variations have more influence than precipitation variations.

For the state as a whole correlations of monthly weather values with the "condition" reports of the Bureau of Crop Estimates and with the reported yields show no very close relationships. The correlations with condition give a general indication that a wet autumn, a warm and dry winter and spring, especially a warm March, and a cool and wet May are the most favorable weather conditions. Yield correlations suggest a warm March and June and a cool and dry May as the only important requisites for a good yield.

In Fulton County, in northwestern Ohio, and in three counties in the central part of the state, certain ten-day periods in April, May, and June are found to exert a more effective influence on the yield than all other weather conditions combined, except that in Fulton County the March snowfall is also an important factor. It is weather conditions during these ten-day periods, especially temperature conditions, that largely determine yield.

R. DEC. WARD

Snowfall on Mt. Rainier. Daily records of snowfall were kept during most of the season of 1916-17 at Paradise Inn, on the southern slope of Mt. Rainier, at an elevation of 5,500 feet. Although the observations were not begun until November 24, 1916, the total depth of snowfall from that date up to the last snowstorm before midsummer, in 1917, was apparently greater than that for any other station in the United States for any entire season, with the single exception of Tamarack, Cal., in 1906-07. This interesting fact is reported by Lawrence Fisher, in a recent discussion of the snowfall on Mt. Rainier (*Monthly Weather Rev.*, Vol. 46, 1918, pp. 327-330). The Rainier snowfall, above referred to, was 789.5 inches. Other very heavy snowfalls previously recorded in the United States are as follows: Summit, Cal. (7,017 feet), 1879-80, 783 inches; Musick station, Ore. (5,000 feet), 1912-13, 612.7 inches; Tamarack, Cal. (8,000 feet), 1906-07, 684 inches; summit of Pike's Peak (14,134 feet), 1892-93, 743.3 inches.

The record at Paradise Inn is the first which has been obtained west of the summit of the Cascades in Washington at so great an elevation. The railways cross the mountains at comparatively low elevations. The highest mining camps where observations have been made are on the eastern (leeward) slopes of the Cascades. The season of 1916-17 does not seem to have been one of unusually heavy snowfall, judging by the records at other mountain stations. Nor is Paradise Inn located at what would theoretically seem to be the region most favorable for a maximum precipitation. At the elevation of the inn the snow usually disappears in the summer. Above it are the permanent snowfields, and snow falls at times when rain occurs at the inn. It seems likely, therefore, that the maximum annual snowfall will eventually be found to occur at a greater altitude than 5,500 feet.

R. DEC. WARD

EUROPE

The Distribution of Population in Southern Macedonia. Southern Macedonia, which epitomizes in itself the geography of the Balkan Peninsula as a meeting point of regions and peoples (see the article "The Natural Regions of the Balkan Peninsula" in this number), is especially deserving of an intensive geographic study. The profitable pursuit of such a study is suggested by Captain A. G. Ogilvie in his paper "A Contribution to the Geography of Macedonia" in the January, 1920, number of the *Geographical Journal*. It is stimulated further by the probabilities of rapid transformation of the region as a result of recent political events. Probable changes in the distribution of the population are forecast by Captain Ogilvie.

The region is one of a strongly contrasted relief of plateaus and basins. The basins, all of tectonic origin and formerly lake-filled, are now terraced and floored by alluvial deposits. In them the water table is never far from the surface, and water may be obtained from wells sunk anywhere, an important matter in a climate of light rainfall tending to summer drought. On the crystalline rocks of the plateaus springs are far apart; and, as on the chalk of Picardy, villages are perforce grouped round them, empty spaces intervening. In the hills, furthermore, agriculture is intermittent, and a constant fight is made against the scrub vegetation. Yet in this essentially agricultural land the inequalities of population distribution are nothing like so pronounced as one would expect. The basins, it is true, are the centers of life and communication, and they claim the largest and most prosperous villages; but the population on the plateaus is surprisingly dense. Political circumstances are largely responsible. Given a normal development under stable government and conditions of security, population will be naturally attracted to the plains.

The available agricultural area in the basins may be increased by drainage of the swamps. At the same time this will help towards the elimination of malaria, which, says Captain Ogilvie, is "responsible for the bad name of the country as much as the proverbial state of political unrest." Irrigation should be organized and regulated. While certain crops, rice for example, can only be grown under irrigation, everywhere in the plains agricultural values will rise with irrigation. It is already practiced in the Struma valley and on some of the larger alluvial fans. The late Turkish landowners of the big *chiftliks* of the plains have already disappeared, and there is opportunity for creation of an equitable system of land tenure. Release of the land from the Turkish yoke should also bring about improvement in agricultural methods and the introduction of modern practices to supersede the primitive methods exemplified by the general use of the wooden plow, the mattock, and the sickle. A number of Greek-owned farms with their specialized devotion to one crop—tobacco, rice, cotton, or cereals—show the possibilities of the fertile plains.

Agriculture and population, however, have probably reached their maximum extension in the hills. Here large areas may most profitably be restored to their pristine

forest cover of valuable timber—oak, beech, chestnut. Elsewhere upland scrub country should be devoted as now to the raising of sheep and goats. At present the pastoral pursuits of southern Macedonia are largely conducted by the migratory Kutzo-Vlachs. In the redistribution of lands care must be taken to reserve winter pasture for the nomads and their flocks in the plains. With the substitution of modern fishing craft for the present archaic types and with the improvement of harbors the maritime population will also gain. Of course, bound up with general progress will be the improvement of the means of communication, now so sadly deficient.

POLAR REGIONS

Norwegian Surveys in Spitsbergen during 1919. The systematic survey of Spitsbergen by Norwegians begun in 1906 and since 1911 carried out annually, as described in the *Geographical Review* (Vol. 8, 1919, pp. 216 and 218), was continued in the summer of 1919 under the leadership of Adolf Hoel. The party comprised three surveyors, two hydrographers, and two geologists. The land between Horn Sound and South Cape (West Spitsbergen) was surveyed, and complementary surveys were carried out around Bell Sound, the total area mapped amounting to 520 square miles. Simultaneously the hydrographic survey was extended from the northern entrance of Bell Sound to the mouth of Horn Sound. Soundings were taken along this coastal section to a distance of 10 to 20 nautical miles off shore. The area hydrographically surveyed during the season is estimated to be 1,620 square miles. The geologists worked principally in the coastal strip between Horn Sound and South Cape; there for the first time they found fossils (erinoids) in the Hecla Hoek formation (locally metamorphosed Silurian rocks). In 1919 the Norwegian Hydrographic Office published a very valuable chart embodying the Norwegian hydrographic surveys of the Spitsbergen coasts to 1918. It is entitled “Nordishavet fra Norge (Tromsø og Varanger) til Spitsbergen” (The Arctic Ocean from Norway (Tromsø and Varanger) to Spitsbergen). The meridional scale is 1:100,000 in 76° N. It differs noticeably from the British Admiralty chart of these waters in the representation of the coast line and the outlines of the fiords. It also contains a great many new soundings on the bank north of Bear Island and off the western coast of Spitsbergen. This chart will be of great value to geographers.

CHARLES RABOT

Completion of Rasmussen's Study of the Greenland Eskimos. Knud Rasmussen, the well-known Danish explorer whose activities have been reviewed from time to time in the *Geographical Review* and the account of whose 1916-18 expedition to northern Greenland was published in the August and September, 1919, numbers, returned late in 1919, according to information received by the undersigned, from Ammassalik, the only settlement of any consequence on the east coast of Greenland. This visit to Ammassalik completes Rasmussen's study of the Eskimos of the entire Greenland coast. He has visited every group from Ammassalik to Etah and knows every Eskimo in Greenland personally. It is safe to say that no one has ever come into such direct intimate contact with a whole people as he has. Part Eskimo himself, born and partly educated in Greenland and trained in languages and ethnology in the University of Copenhagen, he has been especially well prepared to make this study, and he has devoted his life thus far to that work and exploration. It is his ambition to make a comprehensive comparative study of all the Eskimo race from Ammassalik to Siberia.

In his visit to East Greenland he has studied the culture and the language of the East Greenland Eskimos in relation to those of the Eskimos on the western coast of the great island. This comparative study has revealed many facts of noteworthy significance, which he intends to present in the near future. He was surprised to find that the East Greenland Eskimos preserve many of the customs of the Central Eskimos, who still inhabit the ancestral home of the race about Hudson Bay. He found that they are more closely related to the Central Eskimos than are any of the other tribes of the entire Greenland coast and that they have only recently been affected by contact with the Greenland west-coast culture.

Rasmussen made collections of their traditions and folk-lore, of their cats' cradles, and of their artifacts. He studied their language and their customs very closely in order to determine their relationship to the other tribes of Greenland. He states that, though the Ammassalik Eskimos have been superficially very much modified by the Danish administration of the settlement, they are at heart the same primitive people that they were before the coming of the white man. In the immediate vicinity of the settlement they have adopted Danish ways, but as soon as they leave the vicinage of the

grading station they lapse into their old primitive life. The outlying settlements are as typically Eskimo as they ever were.

With his characteristic directness and insight into Eskimo character, Rasmussen has penetrated deeply into their culture and history. He expects soon to publish the results of this latest expedition in full, and though it has not been of a spectacular or popularly attractive character he thinks that it will yield a wealth of scientific material.

W. ELMER EKBLAW

PHYSICAL GEOGRAPHY

Desert Erosion as Illustrated by a Comparison Between the Algerian Sahara and the Libyan Desert. The development of land forms in a humid climate has been thoroughly worked out, but the evolution of the topography in an arid region has not been as satisfactorily explained. Professor W. M. Davis has sketched the main lines of probable development, but he has left to others the task of amplifying and verifying his account and of finding examples of deserts in the varied stages of development.

M. E.-F. Gautier, in a recent paper entitled "Deserts Comparés" (*Ann. de Géogr.*, Nov. 15, 1919), helps to fill in some of the gaps in our knowledge of deserts from the physiographic point of view. He is thoroughly versed in the topography of the Algerian Sahara, and during a few weeks' reconnaissance in the Libyan Desert was struck by the difference between the land forms of the two deserts. This difference he interprets as signifying that the Libyan Desert is in a much later stage of development than the Algerian Sahara, and his description of the relative topography of the young and old deserts is extremely interesting.

The first evidence he brings to support his theory is drawn from the results of fluvial erosion, the *weds* (*wadis* in Egyptian Arabic) of Algeria, the oases of Egypt, and certain delta deposits which are found in Egypt. The *weds* are dry watercourses, related to each other in the same way as are the stream beds of a humid region, tributary channels, graded in size and gradient, leading to trunk streams, etc. The oases on the other hand are basin-like depressions, surrounded by a more or less continuous escarpment, and no trace of a former river system is apparent. Evidently there have been streams in Algeria during a comparatively recent period, while the Libyan Desert has suffered wind erosion for a far longer time. The same conclusion may be drawn from the study of the extensive delta deposits at Wadi Natrun and Moghara. These deltas are of Tertiary age and must have been accompanied by great fluvial erosion. The leveling of all trace of the great valleys corresponding to the deltas could only be accomplished by wind erosion continued during a very long period. The complete absence of all trace of a valley system contrasts strikingly with the fresh-cut Quaternary valleys of Algeria.

The part of the evidence based on fluvial erosion leaves little to be desired; the rest, however, is not as convincing. The character of the Oligocene deposits is next examined. In Algeria these deposits consist of vast alluvial plains, whereas in Egypt the alluvial deposits have been so thinned by wind erosion that often the level bare rock floor of the desert, scoured by the wind, is exposed. These observations, taken in connection with the work of McGee in the Sonora desert, suggest that the later phases of desert physiography may be characterized by bare level expanses where the bed rock is exposed. Before, however, this piece of evidence can be taken to indicate the relative age of the two deserts in question one must be sure that the deposits compared are of the same date, and this is still problematic, the "Oligocene" having been applied provisionally.

The next piece of evidence is that supplied by the dunes. Those of the Algerian desert are related to the alluvial plains. Where there are wide expanses, open to the wind, the dunes pile up. The dunes of Egypt on the other hand are distributed much more unevenly. In the eastern part they are confined to a long narrow line of thin dunes, running almost due north and south. M. Gautier hazards the suggestion that this line may mark the frontier between the natural regions which were once to be differentiated in the Sahara, i. e. the desert in the east and the humid area in the west.

According to M. Gautier's theory this division of the Sahara existed when the Quaternary valleys of Algeria were cut. The dunes of the eastern part of the Sahara are very different again. They are piled up to such an enormous thickness and cover so extensive an area that the land is hardly known. The dunes are as different as possible from the smaller masses of dunes in Algeria, which are not impenetrable. M. Gautier considers that the greater mass of the Egyptian dunes is evidence that more time has been taken to form them. There are other factors, however, it would seem, that might cause dune-formation to go on more intensely in one part of the desert than in another.

E. M. SANDERS

The Distribution of Maximum Floods. Professor Alfred J. Henry, in charge of the River and Flood Service of the Weather Bureau, read before the American Meteorological Society at New York, January 3, 1920, a paper on "The Distribution of Maximum Floods" (*Monthly Weather Rev.*, December, 1919, pp. 861-867). The records of both American and European rivers show an average of seven to ten great floods per century. Such floods are primarily due to precipitation, and the precipitation, in the form of rain, which produces floods may be of two distinct types: (a) so intense and widely distributed as to produce flooding regardless of antecedent conditions. (b) moderate rains continued intermittently for eight to ten days or more with antecedent conditions favorable to a high run-off.

There appears to be no orderly progression in the magnitude of floods with the lapse of years, i. e. the absolute maximum flood of any 100-year period is not necessarily greater than the absolute maximum flood for the preceding 100 years. The magnitude of great floods with respect to the average annual flood seems to increase in a geometrical progression but apparently wholly regardless of the march of time. Further, great floods, like great rainfalls, are essentially a local phenomenon, even for the same stream.

R. DEC. WARD

GEOGRAPHICAL REVIEWS

AFTER-THE-WAR ECONOMIC PROBLEMS

J. E. BARKER. **Economic Statesmanship: The Great Industrial and Financial Problems Arising from the War.** ix and 408 pp.; index. John Murray, London, 1918. 8½ x 5½ inches.

The larger part of this book is given to a consideration of the after-war problems of the United Kingdom. After an introductory chapter on "Coal, Iron—and the Domination of the World" the author seeks to show the relative unimportance of the British war debt. He emphasizes very justly the probability that depreciation of money will do much to lighten the burden, and in succeeding chapters he aims to prove that this burden can readily be borne by a reform in British methods of production. He spent six months in the United States and Canada, and in the light of his experience he urges his countrymen to follow American examples in agriculture, in transportation and manufacture, and in education and research. He would introduce also the protective tariff, which he discusses particularly with respect to its effect on Lancashire and on the shipping trade.

Later chapters discuss the position and future of other countries. The statistics of population and production in France are analyzed to show that that country must be given not only Alsace-Lorraine but also coal from the Ruhr field if it is to maintain its economic position. Italy appears to the author to be in more serious straits, and he sees little probability that in the territorial gains likely to result from the war Italy will satisfy her need for elbow-room and for raw materials. He advances the bold suggestion that the United States and the British Empire should make a free gift to Italy of the needed territory, which he does not more particularly specify. Two chapters cover the ability of Germany to pay a war indemnity, and the final chapter is given to "The Future and the Natural Resources of the United States."

The author is an interesting figure in the world of the English monthly reviews, for which he writes frequently and in which most of the chapters of the present book first came out. He was born in Germany and first published his "Modern Germany" under the name of Eltzbacher, the name appearing as Ellis Barker in later editions. Now he is more British than the Britons. He has a keen eye for good material in original sources, especially statistics, which he cites liberally. He is a deft writer, challenging the attention of the reader by bold generalization and pressing his attack (for he is always aggressive) with a wealth of quotation and illustration. His observations are often shrewd and enlightening; but when he has had his say his assertions often remain still to be proved. He is careless in matters of fact, he handles statistics in an impressionistic manner that makes them often entirely misleading, and he pays little regard to considerations that can be urged against his views.

He measures the productiveness of different branches of activity by value of gross output, with no allowance for raw materials consumed. By this method of measurement the product of American manufactures in 1909 was twenty billion dollars instead of twelve billion. He counts as present wealth in England and Germany the value of the coal deposits, multiplying the estimated tonnage by the price at the surface, with no discount for the time required to get the coal up. He compares English and American transportation rates with no allowance for the difference in the length of the haul or the character of the service. He says that the building of the American railroads was powerfully assisted by the cheapness of iron and steel due to the American policy of high protection. Tariff reform will raise British wages: "Universal experience has shown that the introduction of a tariff has that effect upon the wages of labour" (p. 222). "The doubling and quadrupling of the Imperial railway mileage will undoubtedly double and quadruple the number and the wealth of the Empire's white population" (p. 89). The possibilities of production appear to him in general to be unlimited; he does not know any law of diminishing returns, and Malthus is to him "a well-meaning but fantastic clergyman who dabbled in political economy." Yet when he discusses any particular country he finds its resources limited, and Italy in particular is overpopulated. The American Federal Government appears as an all-wise and farsighted guardian of the material interests of its people. American professors are kept up to their work by the insecurity of their tenure. "Life professorships with pensions after retirement on the European model are practically unknown" (p. 155).

A comparison of the figures of a table on pages 187-188, designed to show that American industrial workers produce three times as much per head as corresponding

British workers, with the figures given in the Final Report on the First Census of Production [Cd. 6320], a British bluebook published in 1912, shows how careless the author is in statistical compilation. In the cardboard trade he excludes the value of "other" products but includes the wage earners engaged; in the paper trade he includes salaried persons with wage earners; in the cement trade he has 18,860 wage earners where the census has 13,860; in the cotton trade he gives a value of £132,000,000 where the census gives £162,000,000. These discrepancies appear in a comparison of part, not all, of the items. Such errors, particularly when they all contribute to support the author's thesis as in this case they do, destroy all confidence in his work.

CLIVE DAY

A STUDY OF TRADE FLUCTUATIONS

D. H. ROBERTSON. **A Study of Industrial Fluctuation: An Enquiry into the Character and Causes of the So-Called Cyclical Movements of Trade.** xii and 285 pp.; diagrs., indexes. P. S. King & Son, Ltd., London, 1915. 7s. 6d. $8\frac{1}{2} \times 5\frac{1}{2}$ inches.

Industrial fluctuations are sure to play an important part in the future just as they have in the past. Therefore, although the war prevented an earlier review, Mr. Robertson's book is worth discussing at this time. It is also worth discussing as an example of the way in which careless handling can spoil a fine subject and largely nullify a great amount of careful research and clear thought. The book is packed with important and pertinent facts as to industrial fluctuations in many countries, especially Britain. It also has the excellence of being built around a definite theory and yet of giving the facts in such a way that the reader can decide for himself whether to accept or reject the theory. In brief the author's contention is as follows: After a period of industrial depression a recovery occurs from the following causes: (1) increased efficiency in production because of lessons of economy and industry learned during hard times; (2) increased natural resources either in the form of good crops or of larger supplies of coal, iron, lumber, and other products which depend largely on geographical surroundings. This increase in nature's bounty causes a relative increase in the value of manufactured articles. (3) Recovery also occurs because of increased hope that future profits may accrue in some of the following ways: (a) because the machinery and other equipment of all kinds which has been worn out but not replaced during the period of depression must be renewed, thus creating a great demand; (b) because of geographical or industrial discoveries; and (c) because of new inventions or new political arrangements. (4) The last of the causes of industrial recovery is the expansion of currency and credit, either through the opening of new gold mines or otherwise. Such expansion leads people to expect a rise in prices in their own particular commodities, and it also lowers interest rates and causes the ultimate consumer to purchase freely. The subsequent decline in business comes through the reversal of these four processes. Space forbids further discussion, but the prominent place occupied by geographical factors is evident.

If Mr. Robertson's book were well written it would be worth reading by a large circle of geographers. Here is a sample of its style: "When fairly faced, the problem of industrial fluctuation becomes nothing less formidable than the problem of maximizing the community's aggregate of net satisfaction through time, in other words of attaining the best distribution through time of its income of consumable goods which is practicable without undesirable restrictions of the total of that income." This is not scientific language: it is jargon. To ferret out the meaning is like pulling teeth, even for the economist. Presumably the author means: "When fairly faced, the problem of the prevention of industrial fluctuation becomes the formidable problem of giving the community the maximum amount of satisfaction. That maximum is not attained by overproduction alternating with underproduction, but by maintaining an intermediate level. This can be done without the undesirable result of reducing the average production below its present level."

It is to be hoped that some day Mr. Robertson will put his interesting theories into such language that readers can concentrate their attention on the ideas and not be forced to expend it on the words.

ELLSWORTH HUNTINGTON

LAND GRANTS TO SOLDIERS

F. C. HOWE. **The Land and the Soldier.** xi and 196 pp. Charles Scribner's Sons, New York, 1919. \$1.25. $7\frac{1}{2} \times 5\frac{1}{2}$ inches.

The theme treated interests all our people; it is closely connected with the future welfare of the nation. Sixty years ago any poor man in our country who had gumption and good health could get land for little or nothing. At first the government charged him \$125 for a quarter section. A little later, under a new law, he could take up the

same area of government land as a pre-emption claim at a cost of only a few dollars for the necessary papers. Farms thus acquired within 25 miles of Minneapolis and St. Paul, for example, are now worth \$25,000 or more, and the farmer can market his produce and get home in his auto-truck in a half a day.

Poor men cannot pay these big prices for land; and the government is already beginning to help the soldier with little or no money to get hold of a bit of land on which he can support his family when he has one. The government will also see that he has a little house and that other needs will be supplied. When he is able, he will be expected to pay for this.

There are many other men, not soldiers, who will wish to make homes and acquire a few acres so that they and their families may be comfortable. All sides of the great question are discussed in this book. It treats of many phases of acquiring and developing small farm properties and tells of the experience of Denmark and other countries that have made a great success of small-scale dairying, poultry raising, and other farm enterprises and are happy and prosperous.

CYRUS C. ADAMS

A GEOGRAPHICAL HANDBOOK ON POLAND

E. WUNDERLICH, edit. *Handbuch von Polen (Kongress-Polen): Beiträge zu einer allgemeinen Landeskunde*. 2nd edit. xxxii and 511 pp.; maps, diagrs., ills., bibliogr., index. Dietrich Reimer (Ernst Vohsen), Berlin, 1918. 11 x 7½ inches.

Warsaw fell before Hindenburg's armies August 5, 1915. Early in 1916 the German governor-general of Warsaw ordered a comprehensive work written on Congress Poland, which means the region called Kingdom of Poland by the Congress of Vienna in 1815. It is the part of Poland that fell to Russia and is therefore quite separate from the portions of that country long included in Prussia and Austria. The name Congress Poland is meant to make this clear. In January, 1917, the "Handbuch" was first issued, and the edition was exhausted in a few months, exciting interest "even in Polish circles." This second edition was issued in January, 1918. During all this time Congress Poland was occupied by the German armies; but the Germans had intimated that they meant to make this territory independent. The treaty of Brest Litovsk, annexing it to Germany, had not then been signed.

Eight of the fourteen authors represented in this volume were on the governor-general's staff, one representative each of the press and big business, and one expert each for agriculture, geography, physics, meteorology, forestry, and geology—a staff equipment characteristic of German thoroughness. The other six were university men of technical training.

Learned and unlearned Germany had been alike in the dark, we are told, about the nature and resources of this region, so near their territory. The Russians had kept investigators out and had discouraged studies by the Polish inhabitants.

The book is a valuable contribution to the geology, physiography, and economics of the country and contains important matter concerning its inhabitants and their material and cultural condition. Although written on conquered ground for the use of a military governor, it does not thereby differ so much from older German books as might be the case if the Germans had been less convinced of their superiority to all other races. It is thorough and clear, makes much use of Polish and Russian sources, and shows personal investigation by the authors. The authors try to maintain an impartial and scientific attitude. It evidently has not occurred to them that their work is propaganda. That there has long existed a hatred of the Germans in Congress Poland is recognized. This hatred is explained as being due to characteristic intrigues of the Russian government. The work of Dr. Schultz and Dr. Praesent on the people of the region shows their belief—not explicitly stated—that the one thing these people need is the protection and guidance of the German government. The governor-general says he was well pleased with the book.

The Germans had no idea there were so many of their countrymen in Congress Poland (719,000) nor that they had preserved their habits and speech so well. Dr. Praesent was astonished to find near Lodz numerous purely German villages masquerading under Polish names.

Of old the Poles were herdsmen in the forest or forest openings. German peasants came in in the thirteenth and fourteenth centuries, cut the forests, and founded innumerable villages and cities in which the Polish nobles, in their gratitude, allowed them to enjoy the freedom customary in German cities. They tilled the land and taught the Polish peasants to till it. There were great numbers of these German peasants, they made the land valuable to the nobles who owned it; but, though eagerly invited, they were soon merely tolerated and then oppressed. The country became a great producer of grain; but the nobles attached the peasants to the soil in order to

keep their labor, and a period of waning prosperity followed. The emancipation of the peasants in 1864 and the introduction of modern tools and methods since then have given agriculture a great impetus. Again, at the beginning of the nineteenth century when the Czar wished to manufacture Russian raw materials within Russian territory and invited German weavers and other artisans to come to Lodz to establish factories Germans came in great numbers and inaugurated the era of industrial prosperity that distinguished that corner of the Czar's dominions. Lodz, which had less than 1,000 people in 1820, has now 500,000, though it has no single feature other than the Czar's whim to make it a suitable site for an industrial city. These two services of the Germans, the introduction of agriculture and of industry, have never been properly appreciated in Germany!

The Poles are said to be bright, cheerful, excitable but not liable to become ugly under excitement, and very patriotic. At work, however, they are clumsy and lack persistence. Polish manufacturing processes and products were unnecessarily costly but enjoyed a vast market in Russia that would be lost in the event of Polish independence; yet it was thought that under better management economies would make it possible to market products within the country.

A peculiar feature of the agriculture of the land is that more than half of it is occupied in small farms by families so large that they consume their whole product. Although two-thirds of the people are agriculturists, the country had to import grain from Russia. The war, by cutting this off and causing inevitable devastation, brought distress! Briefly, but in quite another tone, we read of the "unutterable sufferings" the war brought to the Germans in the country.

The forests have been badly handled, wood being exported in times of scarcity. The best industrial region is south of Lodz, near the coal mines. The mines produced 7,000,000 tons yearly as compared with 44,000,000 tons in Upper Silesia. The capital employed in industry was mostly foreign, mostly German one gathers, though the amount is withheld in a statement that assigns 60,000,000-70,000,000 rubles to France, 15,000,000-20,000,000 to Russia, and 5,000,000 to England.

Next in number to the Poles are the Jews, speaking Yiddish, which is really a modified German, though more of them came from the East than from the West. These 2,000,000 Jews are of low culture, filthy in their habits, and form a majority of the inhabitants of the cities, except Lodz and Warsaw. Russian law forbade them to live in the same villages with Russian farmers. Some of them are factory hands or travel as itinerant tailors, cobblers, or carpenters—a great deal of handwork being customary—but mostly they are peddlers, traders, shopkeepers, or bankers. It was characteristic that in Warsaw handmade shoes were cheaper than the local factory product.

In short, Congress Poland is a transition state between Germany and Russia. Germans, though resisted by Russia, had given it what share of modern culture it possessed. These Germans, intelligent factory hands and farmers, constituted 5 per cent of the population. 75 per cent were Poles, ignorant, inefficient, and amiable; 15 per cent Jews, dirty and ignorant; and 5 per cent Russians and Lithuanians.

MARK JEFFERSON

MINERAL RESOURCES OF SOUTH AMERICA

B. L. MILLER AND J. T. SINGEWALD, JR. **The Mineral Deposits of South America.** ix and 598 pp.; maps, diagrs., ills., bibliogr., index. McGraw-Hill Book Co., Inc., New York, 1919. \$5.00. 9½ x 6 inches.

A thoroughly praiseworthy piece of work has been done by these two authors, who have not merely compiled a list of mineral localities with some comment on the petrography of South America but have also conceived their problem in a broad way and have written informatively. The material is arranged in alphabetical order by countries. There is an introductory section on the physiographic divisions of South America, and the description of each division includes a brief statement of the topographic features, the rocks, and the mineral deposits of economic importance. The discussion is necessarily brief and, from the geographical standpoint, less interesting and valuable than the geographic sections under the several chapters that deal with the countries of South America.

While the absence of geographic features in a book on mineral topics does not constitute a fair basis of criticism, one cannot help remarking that the topographic features are described quite empirically, with no mention at all of physiographic history and no generalization regarding topographic form. The descriptions of the Andes run like the descriptions of the older textbooks, according to mountain chains, mountain heights, passes, etc. The result is that one obtains no adequate picture of the topography of South America as a whole or of the several countries. It would have required no more

space to have described the features in terms to permit generalizations to be made. Certainly if any description at all is given it should be in the form that even a geologist would find useful. Nevertheless it must be said that no similar work has been published and that the material is put in such convenient form that a valuable service has been rendered by the authors in publishing their book.

EUROPEAN TORNADOES

ALFRED WEGENER. *Wind- und Wasserhosen in Europa.* xi and 301 pp.; maps, diagrs., illus., bibliogr. (Series: Die Wissenschaft: Sammlung von Einzeldarstellungen aus den Gebieten der Naturwissenschaft und der Technik, Vol. 60.) Friedr. Vieweg & Son, Brunswick, 1917. M. 12. 9 x 6 inches.

Because of the extraordinary intensity and great frequency of tornadoes in the United States, American meteorologists have rather naturally paid very little attention to these phenomena in other countries, as they there occur in milder form and relatively rarely. Thus in one of the standard American textbooks on meteorology we find only the following statement regarding tornadoes outside of the United States: "They are known in less frequent occurrence in Europe and other parts of the world," and in another recent textbook we read "the tornado . . . is peculiar to the United States, although in a slightly modified form it at times occurs in other parts of the world." Even in Hann's monumental and extraordinarily comprehensive "Lehrbuch der Meteorologie" (3d edition), of the 12½ pages devoted to whirlwinds, tornadoes, and waterspouts, 8½ concern the tornadoes of the United States and the remaining 4 deal with these phenomena in other countries. It is, indeed, almost certain that very few of our professional meteorologists have any clear ideas concerning what we call "tornadoes" in other parts of the world.

For this reason we welcome Dr. Wegener's new and very careful study of the whirlwinds (*Windhosen, Tromben*) and waterspouts of Europe. The author has collected, from a wide range of literature, the available observations and descriptions of these phenomena; he has classified and summarized these accounts from the standpoint of their physical explanation; and he has given a clear and withal an interesting discussion of the various characteristics of whirlwinds and of waterspouts. It is nearly fifty years (Reye, 1872) since any attempt has been made to collect and summarize the facts concerning European whirlwinds. Dr. Wegener has expressly limited his study to Europe, as he says in his preface and as his title indicates, but there are frequent comparisons with the phenomena of American tornadoes. The author confesses that he has not been able to collect all the existing accounts of European whirlwinds, partly because of the exigencies of the war. The preface is dated "In the Field," August, 1916.

The portions of this monograph which naturally attract the attention of an American reviewer are those which emphasize the striking differences existing between the mild, infrequent, and relatively safe whirls of Europe and the violent, frequent, and destructive American tornadoes. Thus (p. 85) four years, 1883-1886, brought, according to Finley, 777 tornadoes in the United States, while the four years with the most tornadoes in Europe, viz. 1884-1887, gave only 35. European thunderstorms bring most tornadoes in autumn and early winter and in the morning hours, while in the United States the maximum number of tornadoes comes in spring and early summer, and in the afternoon. Of 89 weather maps on days with tornadoes in Europe, only 49 showed marked barometric depressions. In relation to the particular octant of the depression in which these disturbances are most frequent, Dr. Wegener's figures show this to be east-southeast. The prevailing direction of progression is from southwest and west, as here. The average velocity is about 14½ miles an hour, which is only about one-third of that in the United States. More than one-half of the paths which can be clearly determined for Europe give an average length of between 0.6 mile and 6 miles (1-10 kilometers). The duration of 61 per cent of the tornadoes which have been studied was between 5 and 30 minutes. But the most striking fact about European tornadoes is their very slight destructiveness. Thus loss of life is reported in only 5 per cent of the cases cited; and a liberal allowance for loss of life, which it is impossible to determine with accuracy, gives an average of 0.4 for the number of deaths per tornado. It is surely unnecessary to give any comparative statistics for the United States. Of 25 cases in which the direction of rotation was noted, 18 showed cyclonic and 7 showed anti-cyclonic rotation.

Dr. Wegener has brought together (pp. 275-279) several personal accounts of the direct contact of ships at sea with waterspouts. This particular relation of waterspouts has been much discussed, and there are many exaggerated views in regard to it. A reading of these narratives leads to the irresistible conclusion that waterspouts relatively rarely do serious damage to vessels which come in contact with them.

There are numerous illustrations of waterspouts, some from photographs and some from sketches, including among the former three pictures of the Marthas Vineyard waterspout of August 19, 1896, but there is no half-tone of a tornado funnel cloud. The remaining illustrations include maps, diagrams, and views of Weyher's experiments in the artificial production of whirlwinds. A brief discussion of the various theories regarding the origin of tornadoes and of the other less violent whirlwinds of Europe leads our author to acceptance of the mechanical theory. In this, "the temperature conditions are not considered the primary cause and the rotation the effect, but the rotation, whether produced mechanically or hydrodynamically, is believed to be the cause of the thermodynamic effects, the latter manifesting themselves in the condensation of the funnel cloud."

Dr. Wegener's monograph very satisfactorily fills in a missing chapter of modern meteorological science. It merits careful study. R. DEC. WARD

JAPANESE RAINFALL

TORAHIKO TERADA, TOKEZO YOKOTA, AND SYOHU OTUKI. **On the Distribution of Cyclonic Precipitation in Japan.** 32 pp.; diagrs. *Journ. College of Sci., Tokyo Imp. Univ.*, Vol. 37, Art. 4, 1916. [Author's abstract in *Monthly Weather Rev.*, Vol. 44, 1916, pp. 127-128.]

All well-defined cyclones occurring in the Japanese region, 1905-1915, were used in making two sets of charts: (1) showing lines of equal percentage of precipitation expectation for different locations of cyclones; and (2) for six divisions of each of the three groups—Pacific, Middle, and Japan Sea—showing by lines the percentage rainfall expectation when cyclones are in different positions.

Temperature differences due to latitude here as elsewhere cause precipitation most frequently on the eastern side of the cyclone. The exposure of the Pacific coast to warm east and south winds gives it greater cyclonic rainfall frequency than the cooler Japan Sea coast.

The land side of a cyclone usually has less rainfall than the water side. On the Pacific coast of Japan the northeast quadrant is rainiest, while on the other coast the expectation of rain is about the same in all parts of a cyclone. On the western coast of Yezo, however, as in parts of western Europe, the greatest frequency comes in the southwest quadrant of a cyclone.

In mountainous Japan, Professor Terada emphasizes the topographic effect on precipitation. For instance, when a cyclone is some distance northwest, the expectation of precipitation is greatest on the coasts. On the Pacific side it rains because of the ocean air rising over the shore and mountains, on the Japan Sea coast because of cyclonic action. Topographical influence on the mere occurrence of rain is most apparent when a cyclone is far away: when it is in the southwest, the rain area extends far north on the Pacific coast of Japan; but when in the northeast, the rain area is most extensive southward on the Japan Sea coast.

These results seem strikingly like a description of the cyclonic distribution of precipitation in the eastern United States, where the Appalachians correspond to the Japanese mountains, and the Great Lakes and Mississippi Valley have effects similar to the Japan Sea (cf. in *Monthly Weather Rev.*: W. G. Reed, Vol. 39, 1911, pp. 1609-1615; C. F. Brooks, Vol. 42, 1914, pp. 318-330; H. H. Clayton, Vol. 44, 1916, p. 81, last paragraph and map).

CHARLES F. BROOKS

TRAVEL ON THE KANSU-TIBET BORDER

REGINALD FARRER. **On the Eaves of the World.** Vol. 1, xii and 311 pp.; map, ills.; Vol. 2, viii and 328 pp.; map, ills., index. Edward Arnold, London, 1917. 9 x 6 inches.

Mr. Farrer is a student of plant life. He visited the boundary region of Kansu-Tibet from south to north to look for flora that might stand the British climate better than products of the warmer parts of China. He was especially interested in looking for new flowers.

"On our grey mood the dawn came grey and weeping" is a fair specimen of the light, literary touch that permeates the whole work and is responsible for the thickness and weight of the two volumes. There is little geography and no geology in the book, but the author gives hundreds of pages to his travels along the roads, the people he met, and his pleasant and disagreeable experiences. Impressions so lightly gained are scarcely more than skin deep and have little worth in evaluating the essence of a country or people. Some three pages given to the vagaries of Mr. Farrer's cook seem to justify

the discharge of that person, but why should the public be called in to act as jurors in the case?

There are frequent though brief allusions to the author's botanical work. Thirty species that he discovered were new to science, and he brought home some plants whose flowers are strikingly delicate and beautiful. The index to the two volumes covers only a little over four pages and is largely botanical.

CYRUS C. ADAMS

A HISTORY OF CHINA

H. PARKER. **China: Her History, Diplomacy, and Commerce, from the Earliest Times to the Present Day.** 2nd edit. xxx and 419 pp.; maps, ill., glossary, index. E. P. Dutton & Co., New York, 1917. \$2.50. 9 x 5½ inches.

This is a new and revised edition of a work that first appeared some sixteen years ago. It is a volume written by an expert, a profound scholar, a man of long residence in China and of wide experience and keen observation. The book is full of just such information concerning China as the busy man and the business man wants.

The only important matter contained in the first edition which is omitted in this is the chapter on the calendar, now no longer needed since the republic has adopted the Western solar year. Three new chapters have been added: one on "Law," a second on "Language and Literature," and a third on the "Rise of the Republic." The chapters of the old edition which have been retained, however, have been largely rewritten; and much new matter has been added to them, greatly increasing the value of the book.

It would be well if all the cynical critics of present-day China could be persuaded to read Mr. Parker's preface. It sets forth in crisp sentences and confident tones the opinion of one who thoroughly understands the Chinese people and sympathizes with them as few Western men can, although he is not blind to their faults. On the situation as it appeared to him in the early months of 1917 he thus comments:

"Suffice it to say that, although in Europe we seem day by day to hear chiefly of revolts and political squabbles in China, as a matter of fact the 'Eighteen Provinces' are not in such a very parlous condition after all, the chief reason for this modicum of happiness being that China is, as it ever has been, a nation of small owners and hardy cultivators, whose ethical teaching has for 2,000 years past inculcated a spirit of deference and order, a right to self-protection, and a family or clannish detachment from public and political authority."

He notes the great increase in the customs revenue which the recent revision of the tariff will further enhance, and he pays a well-deserved tribute to the work of Sir Richard Dane, who has reorganized the salt gabelle. This bids fair to become, probably indeed has already become, a more lucrative source of income than the maritime customs.

The new material in the chapter on "Geography" contains among other things a notice of the work of the Mission D'Ollone of 1906-09 and calls attention to the volume by Jacques Bacot in 1912. Mention is made, too, of the work by Rev. Samuel Clarke, of 1911. All these deal with interesting problems relating to the non-Chinese tribes of southwestern China.

In his chapter on "Language and Literature" the author unfortunately misses the trend of the evidence concerning the relationship between Chinese and Sumerian, which, as it appears to the reviewer, supports the belief, not that Chinese has been derived from Sumerian, but that both have had a common origin in Central Asia, the gradual desiccation of which region has driven the people to emigrate. The explorations conducted by Pumpelly in 1903 and 1904 have demonstrated the existence of a high degree of civilization there at a period placed at 8000 B. C.

E. T. WILLIAMS

THE STANDARD HISTORY OF LONG ISLAND

R. F. THOMPSON. **History of Long Island from Its Discovery and Settlement to the Present Time.** 3rd edit. revised and greatly enlarged with additions and a biography of the author by Charles J. Werner. Vol. 1, 1 and 538 pp.; map, ills.; Vol. 2, 649 pp.; ills.; Vol. 3, 677 pp.; map, ills., index. Robert H. Dodd, New York, 1918. \$18.00. 9 x 6 inches.

This book is assuredly a classic. No one can complete the reading of it for the first time without a sense of discovery; for it was not written, like the average history of a limited area by a non-professional historian, with much attention to sequences and very little to the larger relationships. There is almost as much of geography and economics in the volumes as of historical data. Much of it is made up of material of first-class importance to the social as well as to the political and economic historian.

Though written in the early decades of the nineteenth century it compares favorably with Bruce's "Economic History of Virginia in the Seventeenth Century." Over and above these qualities is the rare judgment of the author and the general historical sense which he displayed in his search for and use of the best materials. Washington Irving commended his work as well as George Bancroft, Henry Clay, and William H. Seward.

It is, therefore, a matter of more than passing importance to have a new edition of this work prepared by Charles J. Werner, a member of the Long Island Historical Society, who has also prepared a biography of the author and other additions that still further increase its value. Mr. Werner has wisely added a number of important photographs, a photogravure portrait of Benjamin F. Thompson, the author, and a large folding map of Long Island.

THE NATIONAL FOREST RESERVES

R. H. D. BOERKER. **Our National Forests.** lxxix and 238 pp.; map, ills. The Macmillan Co., New York, 1918. \$2.50. 8 x 5½ inches.

The author was in the U. S. Forest Service from 1910 to 1917. He is now the arboriculturist in the Department of Parks, New York City. The book is an illuminating treatment of a topic of great public interest. Dr. Boerker speaks of the reckless cutting of mountain forests in France which resulted in devastating floods on the Seine and other rivers and destroyed the fertility of over 8,000,000 acres of tillable land. Most of the damage is not yet repaired. We have suffered, to a small extent, from similar floods; and our annual loss from forest fires has been seventy human lives and from \$25,000,000 to \$50,000,000 worth of timber. We at last became convinced that "forest conservation can be assured only through the public ownership of forest resources." So we have evolved a national forest policy, and its practical workings, thus far, are most encouraging.

Our national forests consist of lands most valuable for growing timber in the western part of the United States that have not been acquired by private individuals. There are 147 national forests, with a total area of 155,166,619 acres—about one-fifth more than the whole of France—the average national forest comprising about 1,000,000 acres. The timber, water, pastures, minerals, and all other resources are for the use of all the people. They are estimated to be worth over \$2,000,000,000 as they stand.

The use of forest and water resources is regulated. The forests are protected from fire and trespass. Agricultural lands are open to settlement, and permanent civilization in the timber regions is resulting. A similar policy has been adopted in the Appalachian region, including the White Mountains; and, by the passage of the Weeks Bill, Congress has voiced the sentiment that the forest-fire problem should be shared jointly by state and nation.

The book describes the administration of the Forest Service, the protection given, the artificial reforestation of devastated areas, and the encouragement to all kinds of business that depend upon national forest resources. The whole story is well told; the half-tones are excellent, but the map is small and poor.

CYRUS C. ADAMS

PROFESSOR BARRELL'S VALEDICTORY

JOSEPH BARRELL. **Sources and Tendencies in American Geology.** *Scientific Monthly*, Vol. 8, 1919, No. 3, pp. 193-206.

It is peculiarly appropriate that this paper should have appeared just at the present time, for it is much more than its modest title indicates. It is a review of achievements in the geological sciences during the past generation, particularly the part taken by Americans in those achievements. Written probably a short time before the author's untimely death on May 4, 1919, it presents a summary of the work accomplished during the period of his activity, as though he had intentionally gathered together the strands of a lifetime's advance in his chosen field, that his survey might be guide and instruction to those who should carry on the task. Furthermore, the closing paragraphs present a brief sketch of the probable future for geology; an outline of the most important problems awaiting solution; a chart that will serve to direct the activities of the coming generation of students in the geological sciences. This is Barrell's farewell address to his colleagues and successors.

THE GEOGRAPHICAL REVIEW

CONTENTS FOR APRIL-MAY-JUNE, 1920

Along and Across the Great Wall of China. By Frederick G. Clapp. (1 insert map, 1 diagr., 23 photos)	221
Our Aquatic Biological Resources. By Victor E. Shelford. (3 photos)	250
The Niagara Cuesta From a New Viewpoint. By A. W. Grabau. (3 maps, 14 diagrs.)	264
The Pre-War Commerce and the Commercial Approaches of the Balkan Peninsula. By Clive Day. (3 maps, 2 diagrs.)	277
The New Boundaries of Bulgaria. (2 maps)	299
The Open Ports of China. By E. T. Williams. (1 map)	306
The Problem of Mayda, An Island Appearing on Medieval Maps. By William H. Babcock. (5 maps)	335
Cloudiness in the United States. By R. DeC. Ward. (1 map, 16 diagrs.)	347
Geographical Record	357

American Geographical Society

Meetings of April	357
Presentation of the Charles P. Daly Medal to Dr. George Otis Smith	357
Notice Concerning the Current Volume of the "Geographical Review"	360

Europe

A Notable Atlas of Population Distribution in Sweden	360
--	-----

Asia

The Climate and Weather of Mesopotamia	361
--	-----

Polar Regions

A Recent Drift in the Kara Sea	361
--	-----

Human Geography

Atmospheric Conditions Which Affect Health	362
The Origins of Civilization	364

Educational Geography

The Extension of Meteorological Instruction	364
---	-----

Geographical News

Obituary	365
--------------------	-----

Geographical Reviews	366
--------------------------------	-----

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OUR CONTRIBUTORS

Mr. Clapp is a consulting geologist specializing in petroleum. From 1902 to 1908 he was connected with the U. S. Geological Survey. In 1914, in association with others, he was engaged in the geological investigation of northern China on which he made the observations recounted in the present article. Among recent papers of his are: "The Ethics of the Petroleum Geologist" (*Econ. Geol.*, Vol. 12, 1917) and "A Review of Present Knowledge Regarding the Petroleum Resources of South America" (*Amer. Inst. Mining Engineers Bull. No. 130*, 1917).

Dr. Shelford of the University of Illinois and the Illinois State Laboratory of Natural History is an animal ecologist. Besides a book entitled "Animal Communities in Temperate America," published by the Geographic Society of Chicago in 1913, he has published numerous articles on animal societies in relation to their habitat.

Dr. Grabau was until recently professor of paleontology at Columbia University. He has specialized in the historical geology of eastern North America. Among his numerous publications may be mentioned: "Principles of Stratigraphy" (New York, 1913) and two papers on the geological history of Niagara Falls (*New York State Museum Bull. No. 45*, 1901, and *Bull. Amer. Geogr. Soc.*, 1901).

Professor Day is professor of economic history at Yale University. In 1918-19 he was a member of the American delegation to the peace conference as specialist on Balkan affairs. He has written "The Policy and Administration of the Dutch in Java" (New York, 1904) and "A History of Commerce" (New York, 1907).

Professor Williams, of the University of California, gained his intimate knowledge of China from more than thirty years of contact with Chinese affairs as a resident missionary and in the consular and diplomatic service. In 1918-19 he was a member of the American delegation at the peace conference as a specialist on China.

Mr. Babcock is a lawyer and author, of Washington, D. C., who has devoted himself to the history of early cartography and geography. The present article is the seventh in a series in the *Review* dealing with the mythical islands of the Atlantic on medieval maps.

Professor Ward of Harvard University is one of the foremost authorities on climate in this country. The present article is the fifth in a series appearing in the *Bulletin* and *Review* of the Society on various aspects of the climatology of the United States.

THE GEOGRAPHICAL REVIEW

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NO. 4

ALONG AND ACROSS THE GREAT WALL OF CHINA

By FREDERICK G. CLAPP

[With separate map, Pl. III, facing p. 248.]

On a cold winter's day, February 17, 1914, with the wind blowing a gale, through drifting sands which cut one's face like a knife, the exploration of the Great Wall of which these pages tell was started by three Americans.¹ We plodded across the country from Shanhaikwan towards the seashore, three miles distant, along the base of the Great Wall. With difficulty we gained its top and finally, though almost blown off, succeeded in walking along it for a mile or more to the Gulf of Liaotung (Fig. 2). Then we vaguely realized that we were standing on the oldest artificial structure we had even seen, and one of the oldest in the world. What an inspiration for a writer to tramp its "ten thousand li"² into Chinese Turkestan!

This was our first introduction to the Great Wall, and we unanimously declared it to be the most impressive landmark we had ever seen—not in its height or breadth alone, but in its length and continuity, and in the magnitude of the task which was successfully accomplished twenty centuries ago by a people whom we had hitherto ignorantly classed as an inferior race.

WHERE THE GREAT WALL MEETS THE SEA

The name Shanhaikwan signifies "Mountain-Sea Barrier," or "Between Mountain and Sea," a designation correctly describing the situation of the city three miles from the sea and about the same distance from the granite mountains, on a broad plain across which tens of thousands of Chinese,

¹ Besides the writer, there were in the party Myron L. Fuller, a prominent American geologist; Kenneth T. McKoy, a fellow citizen who had the fortune also to be a native of China, thoroughly versed in its language and customs; and also two newly made Chinese friends, Wu Kuei-ling and Ho Yen-sun, with all of whom we were destined to become closely acquainted during the succeeding year.

² The Chinese name Wan-li-ch'ang ch'êng signifies "ten-thousand-li-long rampart." The li is the Chinese mile, about one-third of an English mile.



Fig. 1—The Great Wall (inner branch) at Nankow Pass, 35 miles northwest of Peking. The main trade route from Peking to Mongolia, in its ascent & descent of the pass, is shown on the right.

Mongolians, and Manchurians have marched and fought. The eastern wall of the city is coincident with the Great Wall of China, here penetrated by the famous gate known as Hsia-tien-ti-e-mên ("Under Heaven Number One Gate," or "The First Gate in the World"; Fig. 4). At this extremity the wall consists of a high earthen core coated on the outside with bricks.

From Shanhaikwan a pleasant day's excursion can be made along the Great Wall to the summit of Koku Shan, nearly 2,000 feet above the city. Practically all of the wall between the city and the top of the mountains—a distance of five miles—is still standing. The entire length consists of stone or brick steps averaging a foot in height and ascending at a gradient of from 30° to 60°. Aside from the wall, the mountain itself is interesting, since it is part of a great porphyritic range abounding in precipitous cliffs hundreds of feet high, in ancient temples scattered here and there on the hillside, and in extended views up the deep valley of the Koku River. A grand view of the Pei Shan range to the west, capped with snow and cloud, may also be had. Dotting distant prominences are seen watchtowers, relics of a time when China was well defended from the warlike northern tribes. Now, on the contrary, all is deserted, and only at the eastern end of the wall within a few miles of the sea does the presence of the several foreign military encampments—up to the war some foreign troops still remained from the occupation pursuant to the Treaty of Peking—suggest that the line is still of some military value.

Naturally the most noticeable feature in the view from Koku Shan is the wall stretching off southeast across the city of Shanhaikwan to the gulf, seven miles away (Fig. 3). The coast lines can be followed by the eye many miles to the southwest, and in the far distance can be seen the hills of Pehtaiho, the principal summer resort of the foreigners in Peking and Tientsin. Along the gulf a broad plain extends several miles back to the mountains, consisting of igneous rocks of remote geological age, which rise ridge beyond ridge to the south, west, and northwest, cut up by innumerable canyons.

THE "PALISADES," THE MANCHURIAN EXTENSION

The line of defense known as the "Palisades" began on the Yalu River and connected with the Great Wall proper at an angle on the border between Chihli Province and Manchuria north of Shanhaikwan. This line is designated on some maps as a ruined wall. Since our geological expedition crossed it without seeing any structure, it is evidently not everywhere preserved. This wall is, however, delineated on certain maps as far north as the latitude of Mukden, 200 miles away, and there is historical record that it formerly extended in Manchuria at least 400 miles.

FROM SHANHAIKWAN TO THE EASTERN BIFURCATION

From Shanhaikwan the massive masonry and brick wall hardly maintains a uniform direction for a single mile. It climbs mountains, caps pinnacles, crosses valleys, and is on the whole so crooked that to reach the eastern bifurcation near Sihai, 125 miles west in an air line, where it branches, it takes a course of about 300 miles.

We had visited the Great Wall at Shanhaikwan in midwinter. Our



FIG. 2—The beginning of the Great Wall on the Gulf of Liaotung near Shanhaikwan. (Photo by K.T.McCoy.)

next view of it was at Kupehkow (Figs. 5 and 7) on a balmy day in April, when wheat was green in the valleys, spring vegetables were up, and fruit trees, violets, and dandelions were in bloom. About noon we caught sight of a long line of watchtowers on the crest of distant mountains; at two o'clock we arrived close to the wall in the valley of the Chao Ho and saw the frowning battlements, the watchtowers, and the long snakelike line of brick and stone winding up the hillside from crest to crest. The wall remained in sight nearly all day, its towers and battlements standing out in bold relief against the sky.

After nearly two months in the wintry climate and bandit-infested region of northern Chihli, we were as happy as our Chinese caravaneers to be again inside the wall. The difference in prosperity was especially noticeable. From the lowlands to the south in the vicinity of Miyünhsien and Hwaijowhsien the wall can be seen making great zigzags across the face of the gneissic Peita Shan, which rises nearly a mile high.

FROM THE EASTERN BIFURCATION TO THE HWANG HO

About 40 miles north of Peking, at an altitude of 3,300 feet, the Great Wall forks, the inner branch trending southwest to and beyond Nankow Pass, while the outer and more direct branch continues its mountainous way across western Chihli and the whole breadth of Shansi Province to the Hwang Ho (Yellow River). The distance in an air line from the eastern



FIG. 3



FIG 4

FIG. 3—The Great Wall stretching from Koku Shan, a mountain about five miles north of Shanhaikwan, across the lowland plain to the Gulf of Liaotung.

FIG. 4—The first gate in the Great Wall, which is also the eastern gate of Shanhaikwan.

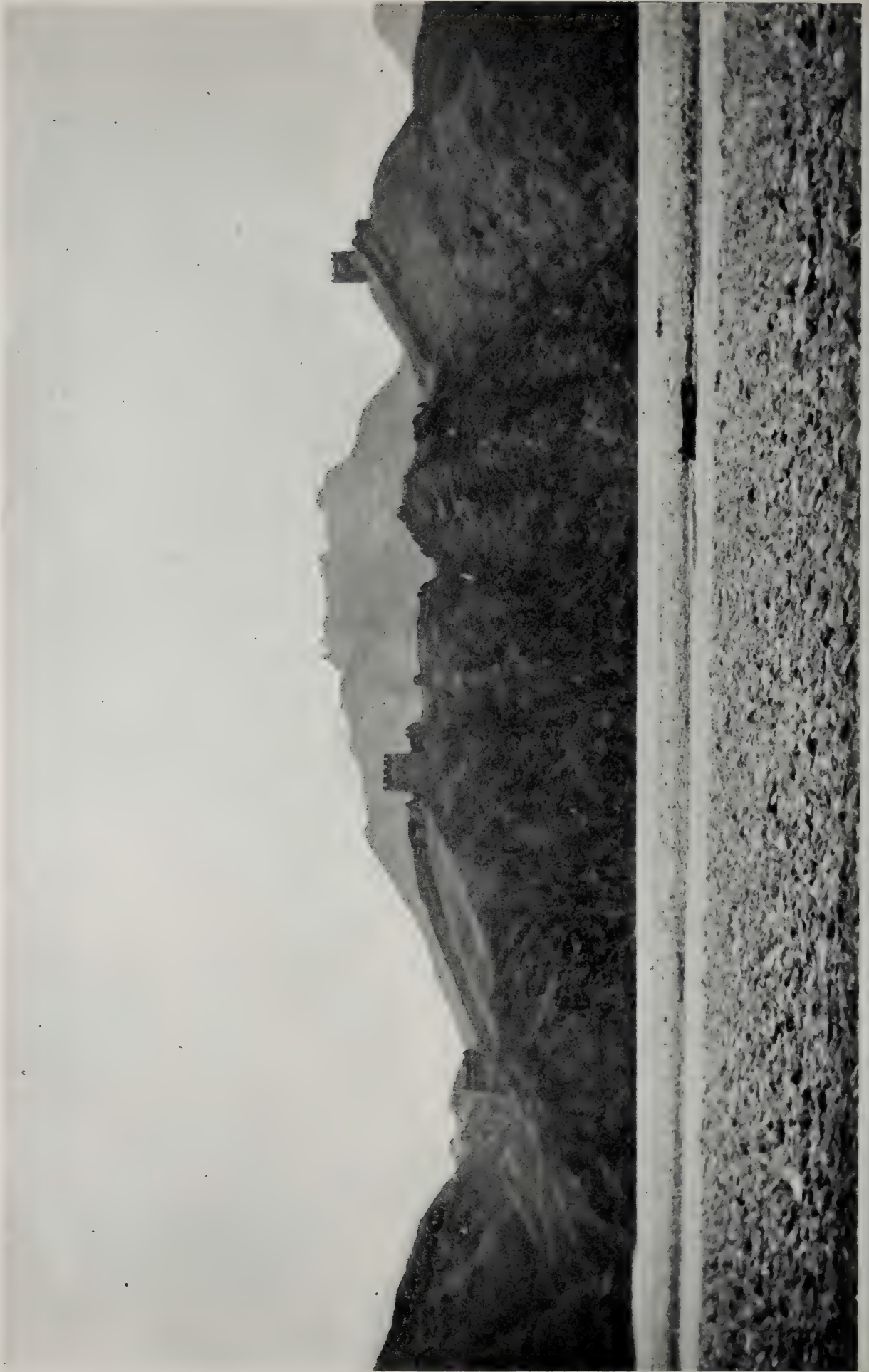


FIG. 5 The Great Wall at Kuehikow, 65 miles northeast of Peking from the valley of the Chao Ho.

bifurcation to the Hwang Ho is 380 miles; but the total length of this section of the wall, following meanders, is 500 miles.

The eastern bifurcation, or point of divergence of the inner and outer branches, appears very definite on the map, but in reality one or more cross walls exist in the fork. A few miles northwest of the main junction is the city of Sihai, once an important place but today almost a ruin. Though only 42 miles in a direct line from Peking, the city, lying behind a mountain range crossed by a difficult pass at 3,400 feet, is very inaccessible. It had not been visited by foreigners for two years.

AN UNEXPLORED WILDERNESS AND RUINED WALLS

The wall north of Sihai follows the mountain ridge and forms the inner boundary of an uninhabited wilderness more than 50 miles across, which the maps record as "unexplored." They are undoubtedly correct, since no magistrate or guide or "oldest inhabitant" in any of the villages visited was able to tell us of any route across it. After leaving Sihai we passed at least five ruins of ancient city walls, crumbling to decay after standing for twenty-three centuries. On prominent hills brick watchtowers (Fig. 9) and signal stations, equally ancient, are seen at intervals of a mile or two, all the way to Tushihkow. By them news was presumably flashed to the gates of the inner wall whenever the Mongols succeeded in breaking through the outer one. On the mountain tops to the north and east of the traveled route the turrets of the Great Wall were frequently visible.

Half a mile north of Shangpu, in the valley of a tributary to the Pai Ho an old wall crosses the valley in an east-west direction, but nothing more is known of it. On published maps the Great Wall appears on the mountain crest, close to the west of Lungmenhsien, but it was not seen at that place. Between Sihai and Kalgan the wall makes a sharp loop northwards. At the head of the loop lies the city of Tushihkow. Here, after crossing high mountain passes and traveling for days on narrow trails, we were back again on cart roads and at the end of another section of the journey. Tushihkow is a good-sized walled city just inside the Great Wall, on the main highway from Peking to Dolon-nor. Four miles northwest of that city the traveled road and the main valley cut the Great Wall, which there runs diagonally in a southwestern direction across mountains of basalt and metamorphic rocks at an elevation of nearly a mile above sea level.

ON THE WAY TO KALGAN

On the edge of the basaltic plateau of Mongolia, 15 miles by cart road north of Kalgan, is a spur or cross wall called the Piencheng trending east and west for several miles. Another of these spurs is mapped 15 miles west of Tushihkow and several others on the outside of the Great Wall west from Kalgan. They are doubtless more numerous than is known.

From the Piencheng to Kalgan the Great Wall itself is either closely adjacent to the highway or is visible on the mountains to the west. It is situated at an altitude of 3,000 to 6,000 feet on rugged basaltic flows capping great gravel beds.

The plateau over which most of the Tushihkow and Dolon-nor route lies is a rolling sand-strewn expanse of lava flows from which low hills occasionally rise. When the sand is not driving, the plateau resembles parts of Saskatchewan and North Dakota. Some portions make fine grazing country, on which herds of sheep, cattle, horses, and camels are seen (Fig. 10).

The descent from the plateau to the valleys below is canyon-like, and grand views could presumably be obtained in clear weather. The poor road becomes a great highway, lined for miles with mules, camels, and carts, transporting goods of various kinds into Mongolia (Fig. 11) and seeming to belie the statement, frequently made, that trade with Mongolia is at an end.

THE LOESS COUNTRY

Far from being clear, however, the day of our descent into Kalgan was one of China's "yellow days," during which the wind blows a gale and the air is full of a mist of fine particles, which, even in the best-built houses, sift in around windows and doors and coat everything with a thin film of yellow dust. This dust is from the famous loess (*huang-tu*) of northern China, a substance which makes this part of the country entirely different geographically and agriculturally from southern China. The dust storms, though a source of discomfort to the residents, are in reality the cause of widespread well-being, since they transport every year millions of tons of fertile loess from the plateaus of Mongolia to the cultivable lower lands of northern and central China.

The loess is a peculiar fine silt or loam hundreds of feet deep which covers vast areas of northern China.³ The majority of the villages west of Chihli are built on the loess or in it, for the houses of many localities are simply caves dug in this remarkable formation. It lies from a few hundred feet above sea level to 7,000 feet above and generally presents a topography of sloping plains, miles in extent, intersected by canyons. Cultivation is largely limited to the loess.

KALGAN, THE GATE TO MONGOLIA

Kalgan (Mongol, *khalga* — pass) lies in a valley about 2,500 feet above sea level, between basaltic mountains rising 1,000 feet higher. Kalgan occupies a strategic situation on the road from Peking to Mongolia. In the Ming

³ Regarding theories of origin and formation of the loess see Bailey Willis, Eliot Blackwelder, and R. H. Sargent: *Research in China*, Vol. 1 (Descriptive Topography and Geology), *Carnegie Instn. Publs.* No. 54, Washington, D. C., 1907, pp. 183-196 and 242-256.



FIG. 6



FIG. 7

FIG. 6—Gate in the Great Wall at Hsifengkow, Chihli, a village two miles east of where the wall crosses the Lwan Ho. (Photo by Myron L. Fuller.)

FIG. 7—A gate of Kupehkwow with the Great Wall in the background.

Dynasty (fourteenth to seventeenth centuries) this place was an international market; under the succeeding Empire it was no less a place of great commercial and military importance, and today the camel caravans that start from Kalgan to cross the Desert of Gobi are among the largest in Asia. The wall at this place is 70 miles outside of the inner wall at Nankow. At Kalgan the wall extends along the ridge of hills in a nearly east-west direction and is very much in ruins except where it crosses the city and is kept in good repair. Many of the towers remain but are somewhat decayed.



FIG. 8—The Great Wall at Hsifengkow. See also Fig. 6. (Photo by K. T. McCoy.)

One afternoon, 35 miles west from Kalgan, in the center of the village known as Jih-erh-ling, we came upon a stone four feet in height, upon which was inscribed the statement that it marks the boundary line between the provinces of Chihli and Shansi. The stone, like many of the oldest structures, stands on a flat loess plain about 30 feet above the present level of the highway, which has been gradually worn down by weather and travel, until, with the modern houses by its side, it now lies in a valley of considerable depth. Many temples and old city walls are on elevated pinacles or masses of loess, which they have protected from erosion, while the surrounding land has been worn away. Many of the highways have been deepened till they lie 50 feet or more below their former level.

IN SHANSI PROVINCE

The main traveled cart road west of Kalgan was out of sight of the wall for 60 miles on account of the looping of the latter to the north, but 10

miles inside of Shansi Province the wall is in plain sight along the Shuimokow Shan, which it follows for over 30 miles, though not all the way on the mountain crests. Continuing west, it makes several loops, passing some 20 miles northwest of Tatungfu, the last telegraph station on the route west, a place of about 250,000 inhabitants, who are crowded within walls a little less than one mile square.

THE INNER WALL FROM THE EASTERN BIFURCATION TO THE HWANG HO

From its junction with the main wall 40 miles north of Peking, a massive



FIG. 9—Old watchtower at Sihai, near the eastern bifurcation of the Great Wall.

line of wall extends southwest with many deviations past Nankow Pass to a point on the border of Shansi and Chibli, thence west and northwest to the junction with the outer wall 30 miles east of the Hwang Ho. The total length of this inner wall, following meanders, is about 400 miles. It is not everywhere preserved, though throughout Chihli Province it is very massive and prominent.

This part of the Great Wall was visited by the writer twice by train in the spring of 1914, and next, on donkey back, in April, 1915. Unlike most trips in China, this is a regular excursion for tourists in connection with the trip to the Ming Tombs. It is only 11 miles from Nankow by rail, up a deep and narrow mountain valley which reaches an altitude of 2,000 feet above sea level, at the end of which the Great Wall itself is encountered, in places at least 3,500 feet above sea level (Figs. 1 and 13).

NANKOW, "THE SOUTHERN PASS"

The railroad station at Nankow is one mile from the walled town, a small

place that, before the days of the railroad, subsisted on caravan traffic to and from Kalgan. Most of the buildings in Nankow are inns. The place has, however, lost its former prestige since Monnier in 1895 described the stream of traffic continuously passing through it on the great commercial road to the north. "There, from year's end to year's end, day and night, pass the loads of wool and furs going down from Mongolia to Peking, and bricks of tea from Tientsin for Kiakhta, on the Siberian frontier."⁴

Nankow means "Southern Pass." The Peking-Kalgan railway approaches it through the "Defile of Chüyung," about 13 miles long. At the lower end it is wild and gloomy, bounded by towering crags, scarcely leaving room for the stony torrent and the railroad; and it has consequently always been a point of strategic importance. There are five subsidiary walls for the protection of the pass, the first of these being the wall and adjoining forts of Nankow, while the other walls are lower down.

About five miles from Nankow is the almost uninhabited village of Chüyungkwan, which, nevertheless, has walls and fortifications four miles in extent and boasts its full share of history, being on the Imperial Road and having proved a barrier to the siege of Jenghis Khan. Here the Imperial Road passes under a fine octagonal marble gate, known as the Kuochieh Ta (Tower Which Crosses the Street), in which are carved figures from Hindu mythology and a multitude of Buddhas. On the gate are inscribed two religious inscriptions dating from 1345 A. D. in six languages or characters, Sanskrit, Tibetan, Mongolian "in Phag's-pa lama characters," Turk-wigur, Hsi-hsia (Tangut), and Chinese.⁵ At a number of places in the vicinity inscriptions in Sanskrit, Tibetan, and Manchu are carved on the rocks.

THE SOUTHERN BRANCH WALL

Extending south from the inner wall near the Wutai Shan in eastern Shansi Province, forming the border between Shansi and Chihli for over 200 miles, is another branch wall. This wall is seldom well preserved but extends in some form as far as the latitude of Shuntehfu, a distance, following meanders, of 230 miles, and one detached remnant has been reported 40 miles farther south.

THE FRONTIER WALL ALONG THE NORTHERN EDGE OF SHENSI

On the left bank of the Hwang Ho, between Shansi and Shensi Provinces, the wall is continued 40 miles southward; thence it runs southwest to the western side of the great loop of the Hwang Ho, defining first the boundary between Shensi and the Ordos Desert of Inner Mongolia, and in

⁴Marcel Monnier: *L'Empire du Milieu*, 1895.

⁵Translations of these inscriptions were made by various writers. They are quoted in Madrolle's guidebook to "Northern China," London and Paris, 1912, pp. 71-72.



FIG. 10—Camels grazing; road from Kalgan to Dolon-nor.

FIG. 11—Carts hauling stores to Mongolia, Han-nor-bá, 15 miles north of Kalgan, on road to Uрга.

FIG. 12—Camel caravan at Laoyehmiao, Chihli, 10 miles southwest of Kupehkwow.

the western 60 miles of this course part of the boundary between Kansu Province and Mongolia.

THE ORDOS DESERT

In Shensi Province the wall was first seen by us on June 17, after three days' traveling, near Shenmuhsien. The scenery had been grand all day. In the evening, as we approached the Niuchwan Ho and looked off to the north, the Ordos Desert, a part of the great Desert of Gobi, was seen for the first time, and we realized that Clark and Sowerby's description⁶ is most appropriate:

The country is wild and inexpressibly dreary. Very few trees are to be seen, and the bare brown cliffs and yellow sand are devoid of any vegetation, save an occasional tuft of some sage scrub. In places, especially where, as in the northeast, it rises to any prominence, gloomy chasms, with deadly quicksands lurking in their depths, gape in the sandstone and the half-formed shale. To north and west the prospect is heartbreaking. Sand-dunes and sand-dunes and again sand-dunes shifting with every storm and obliterating every landmark. Only here and there, as tiny islands in a sea of desolation, small clusters of mud huts, where some little oasis marks the site of a spring or well.

CONQUESTS OF THE DESERT

All published maps record this wall as the "Great Wall." At Shenmu, however, the natives said: "This is *not* the Great Wall; this is the 'First Frontier Wall,' built only four hundred years ago; the 'Great Wall' is farther north." And they added that the "Second Frontier Wall" lies about 30 miles beyond the present frontier, and the "Great Wall" a long way beyond that. History furthermore appears to corroborate the local tradition that the ruins of the real Great Wall lie buried in the desert sands somewhere in the Ordos. Their exact location makes an interesting archeological and historical problem. The past greatness and prosperity of the region is attested by numerous walled cities, ancient buried or ruined highways, and the frequent presence, under the sand dunes, of a rich soil which must have constituted a great fertile valley in some distant period. On this region the northern sands have been encroaching, passing one wall after another, and are now far beyond the southernmost one, relentlessly conquering a once prosperous country on which the fiercest Mongol onslaughts were of little avail.

From Shenmuhsien we followed the Frontier Wall, here an earthen wall, for three days into Yülinfu, over a trail said never to have been traveled by foreigners. We journeyed much of the time across the rolling sandy waste 5,000 feet above the sea which comprises the edge of the desert. On the hills many temples, watchtowers, and the remains of the Frontier Wall (Figs. 16 and 19) testified to the former importance of the region. Now

⁶ R. S. Clark and A. de C. Sowerby: *Through Shên-kan*, London and Leipsic, 1912, p. 22.

the region is almost deserted. This was not the Dolon-nor type of desert, in which enough grass frequently grows to make good grazing and on which villages occur at intervals. The Ordos Desert consists of nothing but hills and valleys of sand, hot and soft, that was driven all day into our faces by a stiff wind (Fig. 15); and there is little vegetation except small scrub on some of the hills. One day we passed through the city of Changlopu,



FIG. 13--The inner branch of the Great Wall at Nankow Pass. (See also Fig. 1.)

which is so rapidly being buried that one must climb over the walls on sand dunes in order to enter (Figs. 17 and 18).

YÜLINFU, AN OASIS OF THE ORDOS DESERT

On the sixth day west of the Hwang Ho we passed a large temple and entered the main gate of Yülinfu, when a wonderful transformation met the eyes. Not a trace existed of the exterior inhospitable scenes; but above the thousands of neat housetops which lay below us we gazed across a broad and green valley, through which flows the Yülin Ho, making a scene as picturesque as could be desired (Fig. 21). Descending the hill we entered the main street, lined with crowds as usual, but the busiest since leaving Tatungfu, as Yülinfu is one of the large cities of China. Yülinfu is comparable with Kupehkwow, Kalgan, and Tatungfu in its geographical importance. It is the center for trade between the Chinese of Shensi and the Mongols of the southern Ordos Desert. The chief products of its markets

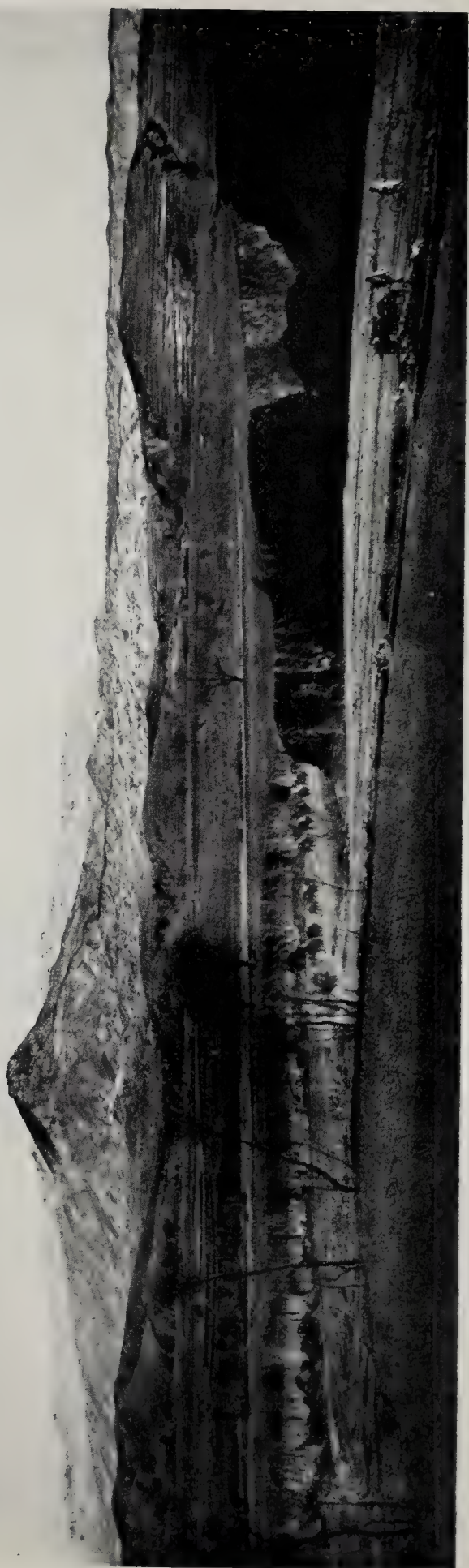


FIG. 14—The mountains along which the inner branch of the Great Wall lies (to be made out along the crest leading up to the peak in the left background), seen from near Hsiangyangkow, a village on the Hun Ho, three miles south of the wall and 20 miles southwest of Nankow Pass. Notice the road in the foreground, worn down by travel in the loess, a peculiar fine silt or loam sometimes hundreds of feet deep which is derived from the deserts of Mongolia and covers vast areas of northern China. (Photo by F. A. Herald.)

are hides, skins, wool, hair, blankets, shoes, socks, etc.; like Kalagan it is noted for its horse fairs. The name Yülinfu means “Elm-wood Prefecture” and would appear to indicate that the city was named at a time when elms were abundant, before the sands of the Ordos Desert had overrun the region. At present thin grass, sagebrush, and a few willows constitute about the only natural vegetation.

On the eastern side the desert sands have been piled high against the city wall, affording an easy entrance to belated travelers who may arrive after the closing of the gates for the night.

THE FRONTIER WALL AND THE GREAT WALL

At Yülinfu a talk with the high commissioner, a well-educated man, who has traveled outside of China, confirmed our theory that the wall now forming the northern boundary of Shensi and designated as the

'Great Wall' on all maps is in reality the 'Frontier Wall,' built about the fifteenth century of our era, while the true Great Wall, built over two thousand years ago, is situated perhaps a hundred miles farther north, near the Hwang Ho, in the Ordos Desert. The intervening country was once extremely prosperous and had a large Chinese population, but now its habitable portions contain only Mongolians.

Since the true Great Wall seems to be beyond our knowledge, so far as the Ordos Desert section is concerned, we must use the Frontier Wall for our estimates of length. The distance across the great loop of the Hwang

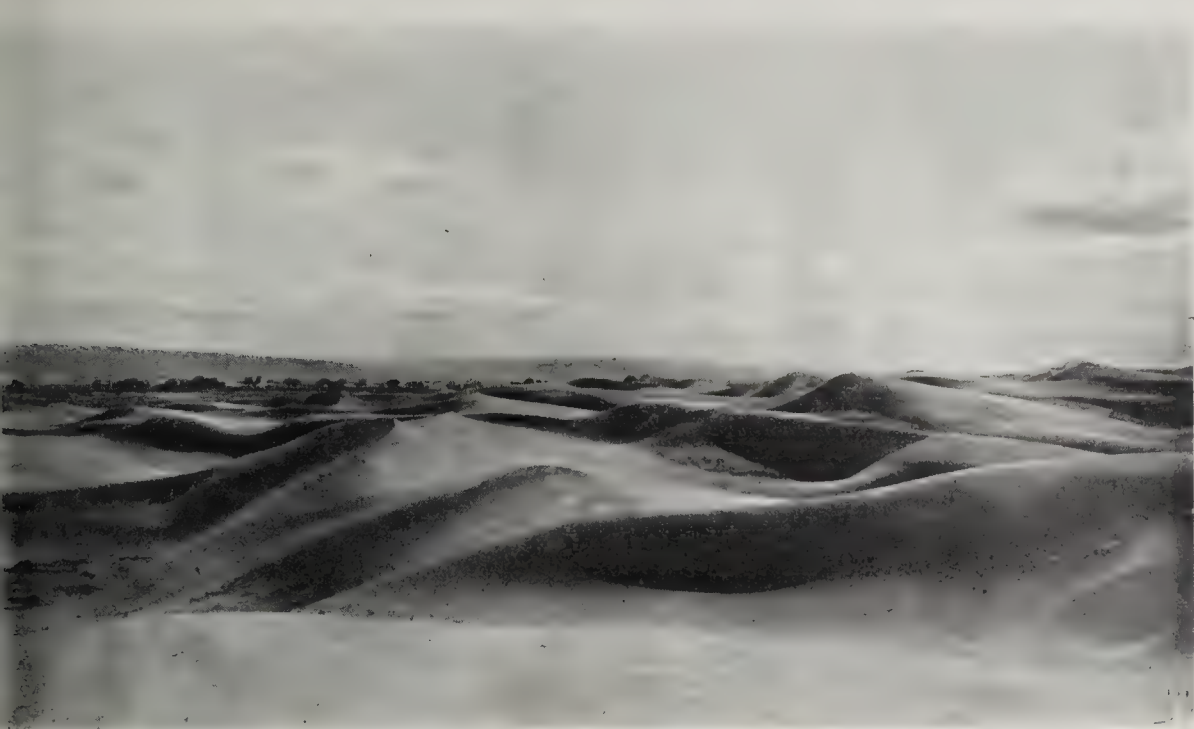


FIG. 15—Sand dunes at the edge of the Ordos Desert near Yülinfu. Camel caravan in left background. (Photo by E. L. Estabrook.)

Ho in a straight line is 250 miles, and the length of the Frontier Wall is 350 miles.

THE DESERT LOOP

The city of Ningsiafu, in northeastern Kansu Province, is 4,000 feet above sea level, at the corner of the Great Wall where the latter turns at an angle of almost 90° and thence trends southwest. Northeast of the city are three arms of the wall extending towards the Hwang Ho.

Now, after having visited Ningsiafu, the writer is at as much of a loss as are the published maps regarding the course of the wall in the first 30 miles west of the northward course of the Hwang Ho. The impression exists that there is a gap west of Ningsiafu but that the main Great Wall is continuous for a few miles farther north along the Ala Shan on the border of Kansu and Mongolia. The distance in a direct line from the known portion of the wall west of Ningsiafu to the western bifurcation at

Tatsing is 160 miles, but the length of this section of the wall is close to 250 miles.

The portion of the Great Wall from Ningsiafu to Liangchowfu has been christened by Geil the "Desert Loop."⁷ It is largely within the Province of Kansu but for a part of the distance forms the boundary of Mongolia along the Hsi or Ala Shan. The country outside the wall here is included in the Desert of Gobi. The greater part of Geil's route in this section lay across a monotonous stretch of sand where deserted villages were numerous. The second city in importance along the Great Wall is Liangchowfu, which is said by Geil to contain a total population of 20,000 families.

THE MAIN LOOP OF KANSU

In the Province of Kansu there is an inner wall about 250 miles in length, which branches from the Great Wall at Chungwei on the Hwang Ho, thence trending south along the river and following the western bank for over 100 miles to beyond Lanchowfu. There, where the river makes a sharp bend, the wall turns northwest along the Pingfan Ho for nearly 100 miles; it then bends north and east at the pass Wushao Ling, where it reaches its greatest elevation, about 9,900 feet above sea level, and again joins the main wall at Tatsing. From Hungcheng to a point north of the Wushao Ling the wall follows the great highway that connects Lanchowfu with Kashgar. The entire inner loop of Kansu is, according to Geil, in ruins and grass-covered.

THE TIBETAN LOOP

The name "Tibetan Loop" may not be strictly correct, since the wall does not touch the true boundary of Tibet, but the term is retained here because the wall extends far in that direction. This loop is about 400 miles in length. It leaves the main Kansu loop at Lanchowfu, rejoining it again near Kulang, north of the Wushao Ling.

Kumbum, on the Tibetan Loop, south of Siningfu, is about 30 miles from the Tibetan border. This city is, next to Lhasa, the most important lamasery in the world, being the home of 3,600 lamas and a favorite resort of pilgrims. The Wall here is variously known as Pien Cheng (Boundary Wall), Chang Cheng (Long Wall), and Wuling Cheng (Five Ranges Wall), the latter signifying that it passes over five ranges of hills.

Siningfu is situated inside the Tibetan Loop on the gentle slopes of the Nan Shan foothills, overlooking several fertile valleys. It has high, massive brick bastions and battlemented walls and is entered through strong gates, the east gate having an enormous portcullis. The city has temples, official buildings, barracks, and several modern schools. Borax, rhubarb, musk, antlers, wool, furs, and fish from the beautiful Koko Nor (lake) are imported from Tibet.

The Tibetan Loop apparently was discovered by Henry French Ridley,

⁷ W. E. Geil: *The Great Wall of China*, Shanghai, 1909, pp. 176-193.

“the hero of Sining” during the Mohammedan rebellion of 1895-1896. This loop appears on no published map except that accompanying Geil’s volume and that drawn for the present paper. While it is not of great antiquity, it is believed by scholars to lie on the line of an ancient wall of great size dating from the Chin Dynasty.

THE WALL IN THE PANHANDLE OF CHINA

The remaining undescribed section of the wall proper is that in the “panhandle” of Kansu Province. It leaves the Kansu loop at Tatsing and follows in a general way the border of Mongolia for 350 miles, continuing thence to Chiayükwan, a total distance of 450 miles (air line distance 320) from Tatsing, and protecting on the north the cities of Liangchow, Kanchow, and Suchow. Liangchow is described as an attractive city, but many of the city walls near the line of the Great Wall northwest of the city are mere skeletons, containing neither population nor buildings. The Great Wall in this portion was doubtless once veneered with brick and stone, but only a loess core now remains.

The city of Kanchow, though on the line of the Great Wall during Marco Polo’s visit, has now been moved seven miles south. The region in which it lies is a rich agricultural one, producing wheat, pears, beans, melons, and hemp. It is famous, too, as the home of the world’s rhubarb stock. In the days of Marco Polo Kanchow had three Christian churches but now has only one.

Suchow, the northwesternmost city of China proper, is situated 5,053 feet above the sea, at and very near to the western end of the Great Wall. It is a place of 4,000 families and is famous for its production of jade.

END OF THE GREAT WALL IN CHINA PROPER

Twenty-three miles west of Suchow is Chiayükwan, the western terminus of the Great Wall. Just outside of Chiayükwan is a stone tablet, bearing an inscription signifying the importance of this outermost post of defense on the great military barrier.

According to Geil, however, the real end of the Great Wall is not at Chiayükwan but five miles southwest of it on the banks of the Tapai Ho (Big White River) and in sight of the mountains of Tibet. Not a sign of human life exists in this desolate spot. The wall stops short at the brink of a precipice 200 feet high, below which flows the great river. The color of the stream is in great contrast to that of the Hwang Ho, this river being the product of melting snows in the neighboring mountains of Tibet flowing through limestone, while the Hwang Ho derives its sediment largely from the finely disseminated loess.

THE GREAT WALL IN CHINESE TURKESTAN

Although Chiayükwan may be the western end of the Great Wall of



FIG. 16.—Towers of the "First Frontier Wall," constituting the boundary between Inner Mongolia and the Province of Shensi, seen from Changlopu near Yulinfu. The wall is here being buried gradually by the sands of the Gobi Desert.

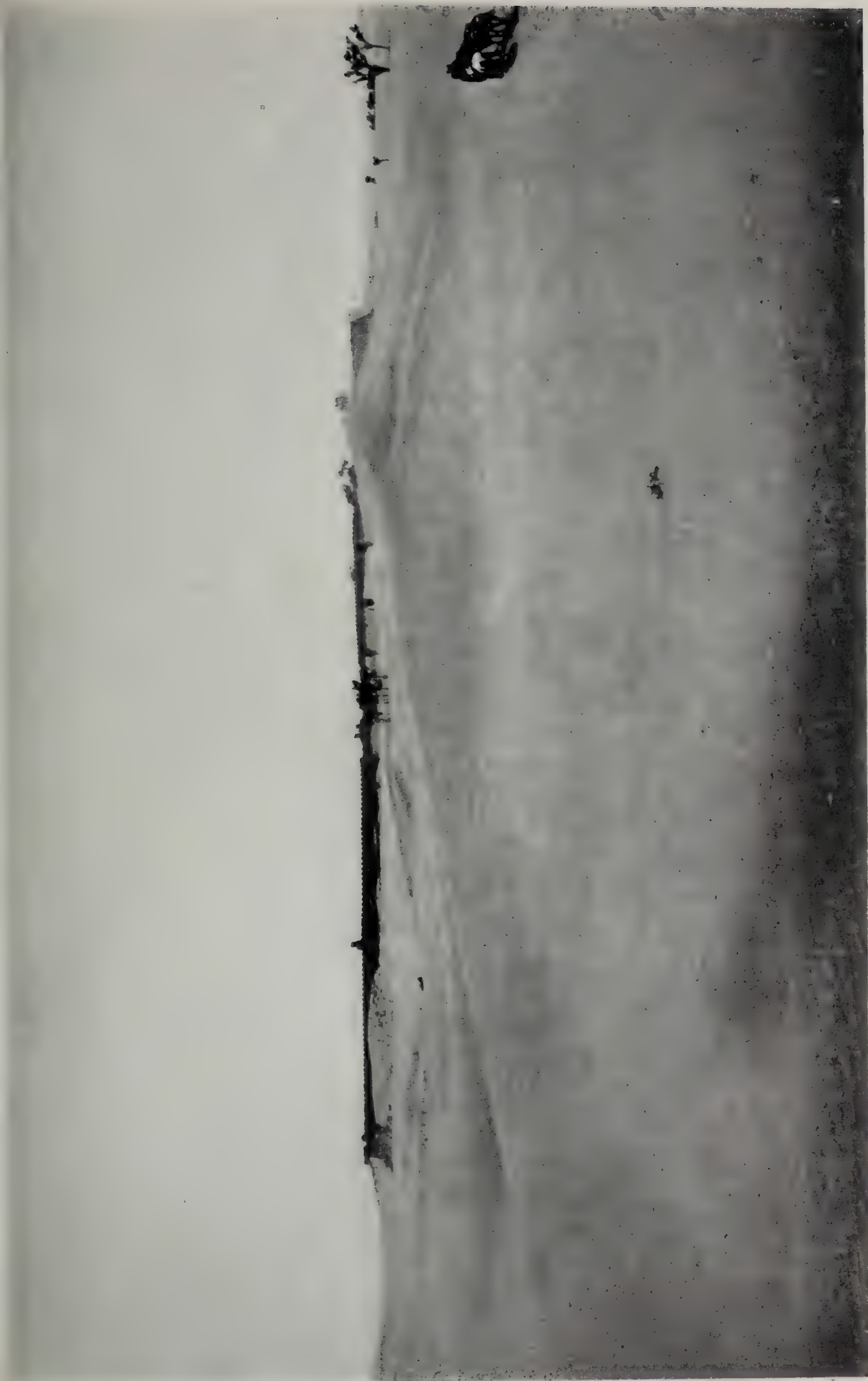


FIG. 17 The city of Changlopu, 12 miles northeast of Yülinfu, which is rapidly being buried by the sands of the Ordos Desert.



Fig. 18—A temple and the city wall at Changlopu buried by the desert sands. (Photo by E. Day.)

built during the reign of Wu Ti (140-87 B. C.) of the Han Dynasty. The regular garrisoning of the wall continued through the first century before Christ and, over the greatest part of the wall's length, down to the second century of our era.

Dr. Stein ascribes the main purpose of this frontier wall to the necessity of guarding from the Hsiungnu, a nomadic tribe of Huns who lived in the Mongolian desert, "the territory south of the Sulo Ho, which was indispensable as a base and passage for the Chinese Military

China, as commonly recognized, it is certainly not the western end of the Great Wall system, as other stretches forming part of the same general military system are known in the desert sands beyond. The first person to show that the Great Wall does not end at Chiayükwan was Dr. Aurel Stein,⁸ who visited Central Asia in 1901 and on his second trip, in 1906-1908, traced ruins of ancient frontier walls to a point about 250 miles west of Chiayükwan, or an additional wall length of at least 300 miles. According to authentic records these walls were



Fig. 19—Looking southwest along the First Frontier Wall from inside a ruined watchtower near Kaokiapu, 30 miles northeast of Yülinfu.

⁸ M. A. Stein: Explorations in Central Asia, 1906-08, *Scottish Geogr. Mag.*, Vol. 26, 1910, pp. 225-240 and 281-293.

forces, political missions, etc., sent to the Tarim basin''⁹ on the eastern edge of the Takla-makan Desert in the Lop-nor region. Stein collected a great number of documents from watchtowers, sentry stations, temples, etc., along the wall. He pays a just compliment to the Chinese engineers for their skill in the selection of the proper course for the wall, which in this section was uniformly 8 feet thick and about 12 feet high, with the usual watchtowers rising to 30 feet or more. In some places just inside the wall the ancient tracks worn during centuries by the feet of patrols are still visible as a furrow 20 feet inside the wall.



FIG. 20—Ruins of the First Frontier Wall 3 miles north of Kaokiapu. Horizontal sandstone.

Stein observed this wall on the southern side of the Sulo Ho at Anhsi, and on the northern side of the Sulo Ho for 50 miles east, and at a point 95 miles northwest of Chiayükwan. He also maps it 50 miles west of Anhsi at a point 25 miles north of Tunhwanghsien, where is situated his famous cave of temples known as the "Halls of the Thousand Buddhas." Farther west the wall is mapped on the southern side of the Sulo Ho to about 75 miles west of Tunhuang. In intermediate places the wall is in ruins or was not seen. The last observed watchtower was 280 miles due west of Chiayükwan, and we do not know how far the Great Wall extended west through the desert of Kum-tagh.

⁹ M. A. Stein, *op. cit.* p. 238.



FIG. 21.—Yülinfu, northern Shensi. The city, which lies just within the First Frontier Wall, is the center of the Shensi frontier.

LENGTH OF THE GREAT WALL

The length of the wall in its entirety may now be considered. The total length estimated by various authorities is:

Chinese legend	10,000 li (about 3,333 miles)
Li Ung-bing ¹⁰	1,500 "
W. E. Geil (without branches).....	1,250 "
" " " (with branches)	2,500 "
F. G. Clapp (without branches).....	2,150 "
" " " (with branches)	3,930 "

The details of the wall, summarized according to the estimates of the present writer, are:

Great Wall Proper

Shanhaikwan to eastern bifurcation	300 miles
Eastern bifurcation to Hwang Ho.....	500 "
Frontier Wall along northern Shensi.....	350 "
Ningsiafu to Liangchowfu	250 "
In "panhandle" of China	450 "
In Chinese Turkestan	300 "
Total	2,150 "

Branches and Loops

Manchurian extension	400 miles
Inner Wall from eastern bifurcation to Hwang Ho.....	400 "
Southern Branch Wall	230 "
Main loop of Kansu	250 "
Tibetan Loop	400 "
Miscellaneous branches	100 "
Total	1,780 "

Summary

Great Wall proper	2,150 miles
Branches and loops	1,780 "
Total	3,930 "

THE BUILDING OF THE GREAT WALL

Little has been written on the Great Wall in a comprehensive way, and for that reason many misapprehensions exist as to its position, extent, state of preservation, history, etc. In the first place, one must not suppose that

¹⁰ Li Ung-bing: *Outlines of Chinese History*, Shanghai, 1914.

the Great Wall is a structural unit, or that it was constructed all at one time. A number of separate walls, dating back several centuries, had been constructed bordering on the domains of the Hsiung-nu before the reign of the so-called "First Emperor," the tyrant Hwang-ti, who buried alive hundreds of scholars and burned nearly all the books of the Empire. One of the separate walls, for instance, was built as early as the year 469 B. C.



FIGS. 22 and 23—Views of the Great Wall at Nankow Pass to illustrate the method of its construction. In places the top of the wall is level enough for an automobile, as in Fig. 13; but in others it consists of massive flights of steps, as in Fig. 22.

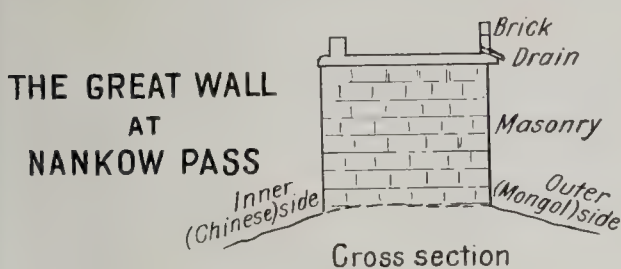
Prince 'Hung-shan.¹¹ The "First Emperor" (246-210 B. C.) in reality united and strengthened the existing walls. The building of new walls, however, did not cease with the emperors of this dynasty. There is no doubt that during the past 2,200 years the Chinese have built more than a dozen Great Walls of as many varieties of construction.

Furthermore, it is evident from the tablets which are frequent along the Great Wall that repairs were made from time to time. For instance, the wall was repaired in the reign of Hsien-Tsung (1470 A. D.) of the Ming Dynasty, and 200 miles more were added in 1547 A. D. Some repairs were made as late as the beginning of the Ching (Manchu) Dynasty, since when no attempt has been made to keep the wall in repair.

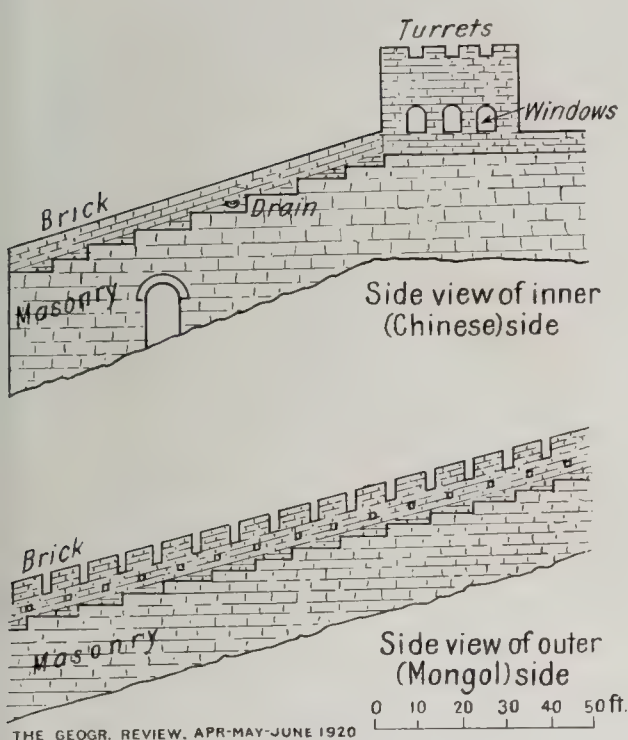
¹¹ Edouard Chavannes: Les plus anciens spécimens de la cartographie chinoise, *Bull. École Française de l'Extrême Orient*, 1903, pp. 221-222.

METHOD OF CONSTRUCTION

The height of the Great Wall is not uniform throughout its extent. It



averages 22 feet but varies from 20 to 50 feet; the base is 15 to 25 feet thick, and the top 12 feet or more; in places the wall is solid and level enough to support an automobile; but in others it consists of massive flights of steps. At intervals averaging 600 feet are towers 40 to 60 feet high, formerly used as sentry stations for the protection of combatants and as vantage points in fighting.



The entire eastern section and that at Nankow Pass are built of massive masonry and huge bricks and are mostly well preserved; but farther west the wall is much less substantial, has fallen in many places into decay, and in Kansu Province resembles a large mud bank. In places it was constructed of earth, in others of brick or stone; and in some parts the towers are in far better state of preservation than are the

FIG. 24—Cross section and side views of the Great Wall at Nankow Pass.

intervening portions of the wall. In many places tablets (generally consisting of a lengthy enumeration of the officials in charge of the work) are placed to record the construction or repairs to the wall. Certain indications found in the brick work, in legends and in tablets, indicate that in some parts the towers were built first and then the walls constructed between them.

In many parts of Shensi and Shansi the character of the loess formation is such that it can be simply cut out into the form of a wall—which plan in reality was very effective. The material was simply split down vertically and then faced with stone. A moat bordered the wall through parts of these sections. In other places the wall had to be built up of loess, above

the plain. A wooden framework was constructed; the loess was thrown in watered, and rammed; then the framework was removed, leaving the wall fully constructed. Even where built of loess the wall, in spite of long neglect, is generally distinctly traceable between the towers.

WALL STRUCTURE AT NANKOW PASS

The Great Wall at its best can be judged from the section at Nankow Pass (Figs. 1, 13, 22, 23), where it was well constructed, is in an excellent state of preservation, and is typical of the eastern arm extending to Shan-haikwan, a distance, following meanders, of over 300 miles. The cross section and side views at Nankow Pass are shown in Figure 24.

At Nankow Pass, and generally in the mountains, the wall is composed of granite blocks for a height of 20 feet above its base, the blocks being five feet long and one foot square, set in two parallel furrows cut 25 feet apart in the solid rock. The blocks are not rough stone but are accurately cut and have evidently been hauled long distances from the quarries. Some blocks are as much as 14 feet long by 3 or 4 feet thick. The upper part of the wall is composed of bricks, some as much as 22 inches long, others 14 inches square and $3\frac{1}{2}$ inches thick and, as has been said, of better quality than most brick made at the present day. We do not know how the heavy bricks were transported from place to place across the almost impassable mountains; but one legend says they were dragged by goats. The mortar that holds the bricks together is better than the Chinese can make at the present time. The Chinese have great faith in it as a medicine and allege wonderful cures with certain prescribed mixtures.

At intervals of a few hundred feet are doorways leading to the inner (Chinese) side and steps leading to the top, so that soldiers could easily ascend to defend it against invasion. Every few hundred feet are the watchtowers, 30 to 40 feet square and 40 feet or so in height. The towers were carefully numbered by the builders, as, for instance, "Tower No. 55 of the Black Letter Wu Series." The top of the wall in the Nankow section is a roadway 14 feet wide. At intervals of 50 to 100 feet are stone drains to allow rain water to run off the roadway, and the foresight thus shown has helped its preservation.

The engineers who laid out the wall seem to have generally selected strong lines of defense, such as mountain crests and narrow gorges. It is easy to understand the heavy fortifying of the passes and plains, though not so easy to judge the reason for so uniformly fortifying the mountain crests. Huge permanent garrisons were quartered in fortified camps behind the wall. When not fighting, the soldiers engaged in agricultural pursuits, in which they were encouraged by the government through a system of land grants.

THE "GREAT WALL" OF THE FUTURE

The Great Wall is no longer needed; it has served its purpose. The protection it afforded against Mongol and Hun consisted not only in its substantial masonry or piled loess, but in its wonderful continuity, in the alertness of its defenders, in its system of watchtowers and signals, and above all in its expression, concrete and symbolic, as a barrier boundary beyond which no invader could come without incurring the wrath and vengeance of an infuriated people.

One foe alone has not been stopped by the Great Wall. This is the sand of the Desert of Gobi that is driven by wind and climatic conditions southward mile after mile, year after year. Owing to the winds and the deforestation of the country, which may be called China's most serious mistake, the desert will continue to move southward and in a few thousand years render large portions of Shensi uninhabitable. Is there no remedy for this condition? The writer believes there is. A new Great Wall should be constructed, not of brick or stone or earth guarded by soldiers, but a forest barrier guarded by expert foresters. A forest one mile wide along the northern border of the country would probably suffice; in Shensi, at any rate, the project is feasible. Irrigation, too, would assist in reclaiming the desert. Here at least is a vision to encourage Occidental democracy.

OUR AQUATIC BIOLOGICAL RESOURCES

By VICTOR E. SHELFORD

University of Illinois

Introduction

Civilization is dependent upon water—the sea, rivers, lakes, pond streams, and marshes touch every aspect of human life. Much attention has been given to water supply for drinking and domestic purposes, to water power, and to the carrying away of filth and waste from the innumerable operations that are an essential part of modern civilized life. These things are so important and so involved in traditional and vested property rights and the convenience and profits of modern industry that an entire series of important natural aquatic resources has been crowded aside and almost forgotten. These are:

(a) Animal resources: fish, turtles, frogs, mussels, shellfish, and aquatic birds and mammals;

(b) Plant resources: aquatic vegetation, stream-skirting shrubs and trees, providing feeding and nesting places for important animals;

(c) Museum resources: preserves of aquatic and riparian faunas for future scientific investigation and for possible practical uses;

(d) Recreational resources: bathing, rowing, camping, angling, shooting

(e) Esthetic resources.

The preservation of these resources often conflicts with those more generally recognized. Much has been written on the subject of the balance in nature, but little attention has been given to it even in quasi-biological circles. The tendency has been rather to “improve” and “develop” our water resources, including stream and lake margins, as well as roadsides and right-of-ways,¹ without reference to the requirements of animals and plants originally dependent upon natural conditions and of recognized value to mankind. Furthermore, there is reason to believe that the value of the biological products of our coastal and inland waters and water margins has been underestimated.

First, the monetary values assigned such products in census reports have, for some items, been too small. The occasional character of the investigation has been productive of inaccuracy. Only those products which have actually been shipped through market channels have been counted; the local and private supplies often, if not usually, have been omitted.

In 1908 the fisheries products of the United States, exclusive of whales but including mollusks (oysters, etc.) and sponges, were valued at upward

¹ W. L. McAtee: Attracting Birds to Public and Semipublic Reservations, *U. S. Dept. of Agric. Bull.* No. 715, 1918.

\$53,000,000. Of this sum about \$7,000,000 is to be credited to inland waters. Frogs, turtles, terrapin, alligators, and fur-bearing animals were valued at \$500,000. The value of frogs for the entire United States (1908) was \$42,000, while \$15,000 were reported from Oneida Lake (New York) alone, which covers only 80 square miles (1916). Turtles and terrapin are given a value of \$122,000, while the Louisiana Conservation Commission reports \$100,000 to \$110,000 a year for Louisiana alone (1917). There may have been increased catch, increased prices, but not sufficient to account for the differences indicated. In general the state census bureaus, which operate continuously, make larger estimates than the federal bureau.

Second, the real value of aquatic resources has been depreciated by erroneous comparisons. As a rule only fishes, which make up the smaller part of the total, get consideration. Their value is small after pollution and overcatch have reduced their numbers. It has been argued that the fisheries of one of the most productive rivers are not worth as much as the products of the smallest industry that throws waste matter into it. This argument carries much weight with legislatures. It is, however, faulty and untenable. First of all, the values used for fish are their value to the fisherman. The Alaska salmon-canning industry shows² that the value of the fish to the fishermen is about one-third the value of the canned product to the canneries. Fish and other aquatic products should be compared with *raw materials* and not with the products of factories on which much labor has been expended.

Value of Biological Resources

FRESH-WATER FISHES AND MUSSELS

The most prized fresh-water fishes and mollusks are dependent upon clean bottoms, abundant vegetation, and a good flow of water in dry seasons—conditions which characterized our streams in primeval times.³ Clearing of timber has modified stream flow, stream margin shade, etc., detrimentally. Household and industrial effluent dilution has modified the character of the water and covered the bottoms with filth, to the destruction or injury of fishes and their associates.⁴

In the settlement and early development of our country, fishes were very important. There were shad, salmon, trout, bass, alewives, eels, and many other kinds. They furnished a plentiful supply of healthful food, easily

² B. W. Evermann: Alaska Fisheries and Fur Industries in 1913, *U. S. Commission of Fish and Fisheries, Report for 1913, Appendix II*, pp. 1-139.

³ V. E. Shelford: Animal Communities in Temperate America, *Bull. Geogr. Soc. of Chicago* No. 5. Chicago, 1913.

⁴ V. E. Shelford: Fortunes in Wastes and Fortunes in Fish, *Scientific Monthly*, Vol. 9, 1919, pp. 97-124; *idem*: Ways and Means of Measuring the Dangers of Pollution to Fisheries, *Bull. Illinois State Nat. Hist. Survey*, Vol. 13 (2), 1918, pp. 25-42.

attainable, until the forests could be hewn down and crops raised.⁵ Shad was the most important variety and was abundant in all Atlantic coast rivers. In Pennsylvania the country folk came from fifty miles away to get their winter supply, camping along the rivers and bringing in payment whatever they had of a marketable nature.⁶ Now shad, together with salmon, is greatly reduced in Atlantic coast streams. In the Illinois River years ago the buffalo fish afforded the chief marketable species. In recent years it has constituted less than eight per cent of the total fish catch. Buffalo-fish eggs are unusually sensitive to various unfavorable influences. The whitefish of the Great Lakes, which served as bread, meat, and vegetable to the early explorers and settlers, was once abundant.⁸

Ruthless catching has been followed by sewage, and sewage by industrial wastes.⁹ Lead works, zinc works, tanneries, paper mills, and gas plants¹⁰ turn valuable and extremely poisonous substances into the streams and lakes. In Europe nearly all industrial wastes have been converted into something useful.¹¹ In America manufacturers have not cared to spend time and energy in dealing with the matter.

The extent of the damage done by pollution at the present time may be judged by the fact that 60 per cent of the suggestions concerning the improvement of fisheries and the increase of the product during the war dealt with pollution. The condition of streams in America is worse than in Europe mainly because Europeans have been giving attention to the matter while we have neglected it.¹²

Fresh-water mussels for making pearl buttons constitute an important resource. It is one which is decreasing, however, from overcatch and pollution which destroys the fish upon which the mussels depend.¹³ In 1908 the value of the mussels taken from the Mississippi and its tributaries was estimated at \$686,000.¹⁴

MARINE FISHERIES

The marine fisheries of the United States in 1908 had a value of about \$45,000,000. The sea and its shallows are highly productive of human

⁵ Harrison Wright: On the Early Shad Fisheries of the North Branch of the Susquehanna River, *U. S. Commission of Fish and Fisheries, Report for 1881*, pp. 619-642.

⁶ W. E. Meehan: The Battle of the Fishes, *Canadian Fisherman*, Montreal, Vol. 4, 1917, pp. 275-277.

⁷ This information was supplied by Mr. R. E. Richardson.

⁸ F. N. Clark: A Plan for Promoting the Whitefish Production of the Great Lakes, *Bull. U. S. Bur. of Fisheries*, Vol. 28, 1908, Part I, pp. 635-642.

⁹ M. C. Marsh: The Effect of Some Industrial Wastes on Fishes, *U. S. Geol. Survey Water-Supply Paper* 192, pp. 337-348.

¹⁰ V. E. Shelford: An Experimental Study of the Effects of Gas Waste Upon Fishes, with Especial Reference to Stream Pollution, *Bull. Illinois State Laboratory of Nat. Hist.*, Vol. 11, pp. 382-412, Urbana, 1917.

¹¹ Theodor Koller: The Utilization of Waste Products (translated from second revised German edition), London, 1915.

¹² H. B. Ward: The Elimination of Stream Pollution in New York State, *Trans. Amer. Fisheries Soc.*, Vol. 48, 1919, pp. 3-25.

¹³ R. E. Coker: The Protection of Fresh-Water Mussels, *Bur. of Fisheries Doc.*, 793, 1914.

¹⁴ The Fisheries of the United States in 1908, U. S. Bureau of the Census, Washington, D. C., 1911.

ood, including fish, shellfish, crustaceans, trepang, etc.,¹⁵ it has been said that four square feet of ocean will support a human life.¹⁶ The cultivated mussel beds of Conway produce 8,600 pounds of flesh per acre, while the productivity of land in beef is about one-ninth of this. The dry mussel flesh is about six-tenths of the dry organic matter produced in grain from the same area of land. Investigation of the possibilities of food culture of the sea should be greatly extended; our knowledge barely exceeds that of the savage. There are many marine animals not ordinarily eaten which are excellent food.

The supply of lobsters, cod, and many other fish decreased markedly soon after the beginning of the industrial period in New England. This was in part due to overcatch and to the damming of rivers, as stated before, but pollution of the seas was no doubt an important factor also. It is probable that pollution of the sea affected runs of herring and had an important influence on the decline of the Baltic cities in the fourteenth century and on the rise of Amsterdam.¹⁷ In fact, marine animals of economic importance require pure water, clean bottoms, and natural vegetation. Practically all changes accompanying settlement are detrimental to the best food species. The sea is large, but marine animals are much more sensitive than fresh-water animals.

FISHWAYS

For the proper protection of fishes and mussels fishways, fish elevators, etc., are needed in connection with river improvements. In the North Branch of the Susquehanna, in Pennsylvania, "the shad industry was wholly abolished by the erection of dams to feed canals (early in the last century), and thousands of dollars of capital invested in the business was instantly swept out of existence."¹⁸ The canals have been quite generally abandoned in recent years. Experience with such improvements raises the question of their permanent value.

The best type of fishway¹⁹ is the stream itself, and the aim should be to reproduce stream conditions so far as current is concerned. A cost equaling half the cost of the dam is not too much to expend to accomplish the desired result. Fishways have usually been added to completed dams as a sort of cheap adjunct after the fishes have already been depleted from several years of failure to migrate. The importance of fishways is well

¹⁵ James Johnstone: *Conditions of Life in the Sea*, Cambridge, 1908; see especially pp. 178-205.

¹⁶ I. A. Field: *The Ultimate Sources of Marine Food*, *Trans. Amer. Fisheries Soc.*, New York, Vol. 45, 1916 pp. 177-190.

¹⁷ John Yeats: *The Growth and Vicissitudes of Commerce in All Ages*, London, 1887.

¹⁸ Work cited in footnote 5.

C. G. Atkins: *On Fish-ways*, *U. S. Commission of Fish and Fisheries, Report for 1872-73*, Part II, pp. 591-616.

¹⁹ Hector Von Bayer: *Fishways*, *Bull. U. S. Bur. of Fisheries*, Vol. 28, 1908, Part II, pp. 1043-1057.

illustrated by a statement by Coker²⁰ relative to the Mississippi dam at Keokuk, Iowa, which runs as follows: In their early stages of development pearl-button mussels are parasitic on particular species of fish. Conditions which affect the movements of the river herring, which is the host of the niggerhead mussel, and the catfish, which is the host of the pimpleback mussel, may vitally affect the welfare of these important mussels. If the river herring is checked by the interposition of a dam, so that comparatively few find the way into the upper river, two results will follow: (1) the fish will become a rare species in the upper river, and (2) the mussels will become extinct in that portion of the Mississippi River lying above Keokuk—that is in practically the entire mussel-producing portion.

The usual "custom" in such matters will probably be followed here. There will be no fishway until in time we discover that damage has been done, and then the fisheries will not be worth the making of one. In 1908 the fisheries of the Mississippi and its tributaries in Iowa, Minnesota, northern Illinois, and Wisconsin had a total value of more than \$500,000.²¹ The value of mussels and pearls alone was almost \$100,000. If an annual \$600,000 fisheries project is endangered, why could not such a sum reasonably be expended for a suitable fishway?

It is doubtful if any salmon stream should ever be dammed without a fishway costing the full annual value of the fish, if necessary. Salmon were exterminated in the Connecticut River by a dam built in 1798. This also shut out shad and alewives. The value of the shad fisheries of the Delaware about this time was \$200,000 per year. With salmon and alewives included, the Connecticut fisheries should have more than double this. An expense of ten per cent of the annual value of the fisheries could have constructed a fishway quite adequate for all the fish. The very large one in the Susquehanna built in 1873 cost only \$11,053. It probably paid to build this dam in 1798, but whom did it pay? Certainly not starving Europe in 1918.

In general river engineers have taken little or no notice of either fishes or fishways. In 1872 Professor Baird²² said of the cod fisheries: "Formerly the waters abounded in this fish. . . . The tidal streams were choked up with alewives, shad, and salmon. The erection of impassable dams across the streams, by preventing the ascent to their spawning grounds, produced almost the extermination of their numbers. The reduction in the cod and other fishes so as to become practically a failure is due to the decrease off our coast in the quantity of alewives, and secondarily of shad and salmon, more than any other cause."

²⁰ R. E. Coker: *Water-Power Development in Relation to Fishes and Mussels of the Mississippi*, U. S. Commission of Fish and Fisheries, Report for 1913, Appendix VIII, pp. 1-8.

²¹ Work cited in footnote 14.

²² S. F. Baird: *Conclusions as to Decrease of Cod-Fisheries on the New England Coast*, U. S. Commission of Fish and Fisheries, Report for 1872-73, Part II, pp. xi-xiv.

FROGS, TURTLES, AND CRUSTACEANS

The swamps and marshes near all the large cities produce quantities of frogs, but the numbers and values are unknown. The legs are used for food. This constitutes the frog's chief value, but many are used in scientific laboratories. Fifteen thousand dollars' worth are secured annually from the margins of Oneida Lake, N. Y.²³ It is safe to say that this value in frogs is produced on 1,500 acres of shore and shallow water, which means a yield of \$10 per acre without cultivation; and this is only one of many products and values for the same area.

Frogs, like all other animals, must have proper conditions for successful reproduction and growth. The bullfrog requires cool, deep waters and margin shrubbery under which to rest out of water. Other smaller species have definite shore and breeding-water requirements.

Turtles live about lake and river margins and deposit their eggs on land, some in dry sand, some in moist mud, some in decaying vegetation. They are very sensitive to disturbances of their breeding grounds and accordingly decrease as the country is improved. Crayfishes are, as a rule, eaten only by our foreign population but have a distinct value on the market.

BIRDS

North America possesses about two hundred species of game birds which are associated with watercourses, lakes, swamps, and the seashore.²⁴ This number includes 74 species of edible web-footed fowl. Sixteen of these have been shown to feed upon wild rice, wild celery, and pond weeds.²⁵ These three plants supply an average of 25 per cent of their food, more than half of which consists of pond weeds which grow well in waters not too badly polluted. These birds are all closely dependent upon water for breeding.

Ducks eat quantities of grasshoppers, locusts, cutworms, and marsh caterpillars. The rails and coots have similar habits and relations. All are useful to the farmer. There are some sixty species of long-legged slender-billed birds, the so-called shore birds.²⁶ These devour quantities of mosquitoes, horseflies, etc., both adult and larval. Nearly all these birds are very fond of grasshoppers, and many feed on weevils, wireworms, leaf beetles, and other pests of the field. Many birds associated with water are useful to agriculture, and their destruction ultimately results in heavy

²³ Charles C. Adams and T. L. Hankinson: Notes on Oneida Lake Fish and Fisheries, *Trans. Amer. Fisheries Soc.*, Vol. 45, 1916, pp. 154-169.

²⁴ E. H. Forbush: History of the Game Birds, Wild-Fowl, and Shore Birds of Massachusetts and Adjacent States, Mass. State Board of Agric., Boston, 1912.

²⁵ W. L. McAtee: Five Important Wild-Duck Foods, *U. S. Dept. of Agric. Bull. No. 58*, 1914; *idem*: Eleven Important Wild-Duck Foods, *U. S. Dept. of Agric. Bull. No. 205*, 1915.

²⁶ W. L. McAtee: Our Vanishing Shorebirds, *U. S. Bur. of Biol. Survey Circular No. 79*, 1911; also work cited in footnote 14.

losses to the farmer through the increase of insect and other pests. These are also the birds hunted for food and for sport.

MAMMALS

The small fur-bearing mammals closely associated with watercourses—beavers, muskrats,²⁷ skunks,²⁸ and minks—are valuable for their fur. The skunk is counted as a useful animal and is fond of stream-margin thickets. Its bad reputation for taking poultry is unfounded, based largely on rare instances and on the fact that the European polecat, from which it gets its name in some localities, is a serious poultry pest. These mammals decrease or disappear with the destruction of shallow-water vegetation and shore shrubbery.

AQUATIC PLANTS

Aquatic plants are not without value. In aboriginal times a number of rushes of different sorts were used for making coarse mats and other suitable articles. In recent years the leaves of the narrow-leaved cat-tail have been employed in paper making and in cooperage.²⁹ Water plants, notably wild rice, supplied food to the American Indians. Flour of good quality has recently been made from the cat-tail.³⁰ Hedrick³¹ has advocated multiplying the variety of crops. "In China and Japan the corms, or tubers, of a species of *Sagittaria* (arrowhead) are commonly sold for food. There are several American species which under the name arrowhead, swan potato, and swamp potato have given welcome sustenance to pioneers. Our native lotus, a species of *Nelumbo*, was much prized by the aborigines, seeds, roots, and stalks being eaten. *Sagittaria* and *Nelumbo* furnish starting points for valuable food plants for countless numbers of acres of water-covered marshes." Research on the cultivation of these should have been started long ago.

Special Localities

Semi-aquatic situations, such as water margins with their vegetation and swamps and marshes, constitute some of our most valuable and too-little-considered resources. They are linked with all truly aquatic resources in ways suggested above so as to be inseparable from them.

WATER MARGINS

The statistics collected in Illinois show that two-thirds³² of all the birds

²⁷ D. E. Lantz: The Muskrat, *U. S. Dept. of Agric. Farmers' Bull.* 396, 1910.

²⁸ *Idem*: Economic Value of North American Skunks, *U. S. Dept. of Agric. Farmers' Bull.* 587, 1914.

²⁹ J. G. Needham and J. T. Lloyd: The Life of Inland Waters: An Elementary Text Book of Fresh Water Biology for American Students, Ithaca, N. Y., 1916, p. 381.

³⁰ P. W. Claassen: A Possible New Source of Food Supply, *Scientific Monthly*, Vol. 9, 1919, pp. 179-185.

³¹ U. P. Hedrick: Multiplicity of Crops as a Means of Increasing the Future Food Supply, *Science* No. 1035, Vol. 40, 1914, pp. 611-620.

³² Frank Smith: The Relation of Our Shrubs and Trees to Our Wild Birds, *Illinois Arbor and Bird Days Circular No. 83*, pp. 8-17, Supt. of Public Instruction, Springfield, Ill., 1915.



FIG. 1—A sluggish Indiana stream with its margin in a primeval state. Note four zones of vegetation—water lilies, low shrubs, high shrubs, and trees.

FIG. 2—A small Illinois stream with its margin in the original condition. Note a growth of shrubs with a few trees behind them.

FIG. 3—The same stream shown in Fig. 2, about a mile from the point there shown, on the farm of a different owner. A few trees are left, but all shrubs which make important bird-nesting sites have been destroyed by cutting or overgrazing.

which are valuable for eating insects and which, for the most part, are not included with the shore and aquatic birds, are in some way dependent upon shrubbery such as grows on the margins of watercourses (Figs. 1 and 2) and such as might be cultivated along roadsides.³³ The bobwhite, for example, breeds about thickets and is of especial value to the farmer. It has been predicted that in the Middle West, where farmers are inclined to clear away all the bushes (Fig. 3), many of the species dependent upon shrubbery will disappear. The tendency to destroy the thickets, especially on the stream margins, causes an obvious decrease of birds. A good skirting of trees along streams is also conducive to the presence of fish, because many food fishes prefer shade. Shade also greatly increases recreation value. As a rule, the lowest land along streams is not useful for anything but for growing trees and shrubs.

SWAMPS

Those who advocate swamp drainage appear to consider it as an unqualified good. On the other hand, some regard the drainage of certain swamps as an unmitigated evil. The preservation of the entire Everglades swamp region, for example, might seem absurd; but it is not so absurd as it appears if we give full consideration to the value of our North American birds.

Our Southern swamps lie in the direct migration route of many species of birds that are used as food or that destroy crop pests farther north.³⁴ This is so important that through gifts and state acquisition Louisiana has set aside areas of swampy land along the southern coast to serve as way stations for migrating birds and as breeding places for the native species. The marshes and watercourses of Louisiana yield upward of \$700,000 a year in food, furs, etc. No swamp in the Gulf States or Georgia should be drained without full consideration of these losses. Experiment stations should be established, and at these stations studies should be conducted of the means of increasing the productivity of marshes.

Upland marshes also have values similar to those of the lowland marshes and coastal swamps, with an additional and important function. With the clearing off of timber and the draining of such swamps the streams are subject to greater floods and to extreme low water. At extreme low water a very small amount of pollution overtaxes the self-purification mechanisms, with results almost as disastrous to fishes and similar animals as if the low water occurred throughout the year.

There has been much discussion of the necessity of building dams from which water could be slowly released in dry seasons to maintain flow. Why then destroy the upland marshes which serve as reservoirs, or as great

³³ W. L. McAtee, work cited in footnote 1.

³⁴ M. L. Alexander: *Conservation Laws of Louisiana*..., State Conservation Commission, New Orleans, 1916.

sponges holding water and letting it out gradually? Needham and Lloyd³⁵ advocate lowering parts of these below permanent water level and putting the soil thus removed on equal areas. The dry land could be used for agriculture, and the ponds for water culture. Though the science of aquaculture is as yet in its infancy, it appears that fresh water may be made as productive as land.

A part of any large swamp such as the Okefinokee Swamp, or any other natural area, is as valuable as the most expensive American museum, one which requires say an endowment of \$10,000,000 and an annual expense of \$500,000. Such swamps are really museums of living things, the value of which at any time may become infinitely great in the solution of important scientific problems which involve living animals. Each year animals and plants find new uses and new values; a century ago no one would have thought white rats, guinea pigs, and common mice worth saving. If the question of sacrificing all these for a little additional land to cultivate had been raised it would have received but one answer. Yet by far the greater part of our laws of immunity from disease and of heredity—especially heredity of cancer—have been or are still being worked out on these animals. To quote a recent writer on water culture: "We urge that water areas, adequate to our future needs for study and experiment, be set apart and forever kept free from the depredations of the exploiter and of the engineer."

Brackish-water swamps serve as important breeding places for wild fowl. The low wet areas along the New Jersey coast have been notorious for the mosquito pest. The increase of mosquitoes in recent years has been attributed to the decrease of insect-eating shore birds and waterfowl. To perfect the control of the mosquitoes, systems of ditches have been provided by which small fishes, the killifishes, are enabled to get at and devour the larvae and pupae. During the war, in 1917-1918, the munition works discharged a mixture of sulphuric and nitric acids into these waters which repelled the killifishes and locally neutralized the effects of the ditching work.

Recreational Values

In addition to their value as producers of aquatic products used for food, buttons, clothing, etc., streams and bodies of water have a recreational value. The recreation values may be roughly divided into two classes, (a) sportsman's and (b) park. The value of the former may be ascertained by estimating the value of all clubhouses, cottages, boats, launches, etc., which are directly dependent upon the river or lake.³⁶ The value of these

³⁵ Work cited in footnote 29.

³⁶ G. E. McCurdy: Report of Survey and Proposed Improvement of the Fox River, State of Illinois Rivers and Lakes Commission, Chicago, [1915].

C. D. Hill: The Sewage Disposal Problem in Chicago, *Amer. Journ. of Public Health*, Boston, Vol. 8, 1918, pp. 833-837.

is the capitalization, on which interest may be computed. The interest on salaries of caretakers, and value to local merchants constitute the annual value. These activities tend to disappear from badly polluted streams. Park value is best ascertained from the statistics of cities.³⁷ The large American cities (e. g. Chicago) spend annually from \$2.00 to \$4.00 per capita on parks (exclusive of lighting and including interest on investment) and outdoor swimming pools. Clean lakes and streams also have an esthetic value on which no price can easily be set. The question of whether or not streams shall receive untreated wastes beyond a very limited amount, and whether wastes shall be treated or not, is largely an ethical question and is best settled as such. The nation has preserved certain areas as national parks, national monuments, national forests, etc., for the use of the nation as a whole. The states have reserved some similar areas. The humblest citizen has a right to the recreation values of some of the bodies of water near his home, and his children should be able to wade in a near-by stream and pick up stones without danger to health. The day is past, even in America, when these general interests can be sacrificed for the profit of a small group of citizens.

Water Fertilization, Self-Purification, and Pollution

It is a fact that a certain amount of purely household sewage added to water increases nitrogen and hence acts as a fertilizer, producing more food for fish and other aquatic animals. Certain European towns run their sewage into ponds where the yield of carp is increased through the increase of fish food.

In America there is no such thing as purely household sewage; even in the smallest town the garage runs oil and gasoline into the sewers, the creamery adds milk wastes, or the gas plant adds quantities of deadly poison, until there is really no certainty that the process of breaking down the organic matter of the household sewage present into nitrogen available for fish food will go on. In addition, washings from roads surfaced with various tars and oils complicate matters and kill the fish.³⁸ This subject has received careful attention in England.

How much sewage can be used advantageously as fertilizer? The amount that can be used for carp is detrimental to most aquatic resources, because carp are more resistant than almost any American food fish. When is a stream self-purified? The sanitary chemist and bacteriologist have criteria, but they fail for important aquatic organisms. A large number of questions demand investigation. Tests of the toxicity of sewage and

³⁷ General Statistics of Cities: 1916, U. S. Bureau of the Census. Washington, D. C., 1917.

³⁸ W. J. A. Butterfield: *Relation Between Modern Road Surfacing and Fish Life*, Inst. of Municipal and County Engineers, London, 1912.

Industrial wastes and other poisons introduced into the water must be made, as a basis for rendering them harmless.³⁹ The question, often asked, as to whether or not a given substance will injure fishes,⁴⁰ in general cannot be answered. First of all, the resistance of different species and of different ages of the same species, differs as much as fifty-fold for the same poison.

Conditions in streams and other bodies of water vary. The summer low-water conditions are dangerous because of little flow, of concentration of polluting substances, and of high temperature, which increases toxicity; the winter low-water conditions are dangerous because of slow flow and because of the presence of ice, which prevents aëration.

There are various methods, new and old, of treating sewage. It is true that European plants for the recovery of sewage materials by the older processes have failed to pay profits. It is possible that methods, old or new, pay only when the damages which result from pollution are taken into account. The damages must include a value on all resources represented by a stream or other body of water. Sewage contains much nitrogen needed to maintain soil fertility. It is recovered and put into form suitable to return to the land with doubtful success at the present time,⁴¹ but that is largely because of the lack of adequate effort.

The pollution of the sea is quite extensive near our populous areas. The most widely known of its several effects is the contamination of shellfish beds and bathing beaches with typhoid. To prevent this Winslow and Mohlmann⁴² have proposed the sterilization of the New Haven sewage, thus putting a value on sterile media for bathing beaches and oyster beds. The Miles acid, which they favor, gives an effluent less dangerous to fisheries than raw sewage, as a slight treatment by some aërating process removes the SO_2 used and leaves intact all the benefits from the standpoint of public health.

Danger to public health is recognized by the International Joint Commission,⁴³ who gave the opinion that no untreated sewage should be introduced into the boundary waters between the United States and Canada. Here stands the British Empire ready to defend its humblest citizen! The benefit of such a policy in our national waters would accrue to the health of the downstream neighbors of a community that treats its sewage.

³⁹ V. E. Shelford: Work cited in footnote 10; *idem*: Second work cited in footnote 4.

M. M. Wells: The Reactions and Resistance of Fishes to Carbon Dioxide and Carbon Monoxide, *Bull. Illinois State Laboratory of Nat. Hist.*, Vol. 9, pp. 557-571, Urbana, 1918.

⁴⁰ E. B. Powers: The Goldfish as a Test Animal in the Study of Toxicity, *Illinois Biol. Monographs*, Vol. 4, pp. 127-193, Urbana, 1918.

⁴¹ J. E. Porter: The Activated Sludge Process of Sewage Treatment: A Bibliography of the Subject, General Filtration Co., Rochester, N. Y., 1917.

Langdon Pearse: Activated Sludge and the Treatment of Packinghouse Wastes, *Amer. Journ. of Public Health*, Vol. 8, 1918, pp. 47-55.

⁴² C. E. A. Winslow and F. W. Mohlmann: Acid Treatment of Sewage, *Municipal Journ.*, Vol. 45, 1918, pp. 280-282, 297-299, 321-322.

⁴³ G. W. Fuller: Biochemical and Engineering Aspects of Sanitary Water Supply, *Journ. Franklin Inst.*, Vol. 180, 1915, pp. 17-61 (espec. pp. 32-34).

Co-operative Research and Permanent Basis of Production

From lack of knowledge, or through carelessness, we have continually recurring destruction of various natural agencies that work in part toward the good of mankind. Study of these has been made, but our private organizations and our individual efforts are scattered. The work of our government bureaus has often fallen into ruts which have crushed out the individual initiative of the investigators. Often all effort has been directed toward the establishment of the pet hypotheses of those in charge. In our government organizations these investigating bureaus are usually separate, often competitive, usually not based on the logical requirements of the problems to be studied, and frequently guilty of undue generalization. Organization should be such that a complete force of investigators can be put to work on a problem. What should be done with this or that swamp? It is not a problem for engineers alone. First of all there should be a careful study of all its products—wood, lumber, fish, game, furs, etc., and their value. Foresters, zoölogists, ornithologists, chemists, engineers, and ecologists (who deal with the fine adjustments of organisms to one another and to conditions) should constitute a co-operative organization.

It is well to picture the items which enter into the draining or pollution of a shallow lake or bayou. Assume that the body of water lies in a populous region, contains 40 square miles of water and swamp, and is connected with a stream used for water power, for recreation, for waste dilution, and for navigation. On its shores is a small city of 10,000 inhabitants. What is its value in a primeval state?

ESTIMATED VALUE, BEFORE DRAINING, OF THE RESOURCES OF AN IMAGINARY LAKE
NEAR A SMALL CITY

Food and Clothing

Frogs and crayfishes shipped.....	\$15,000	
Fishes and turtles shipped.....	12,200	
Fish caught by anglers	300	
Game birds shot	300	
Plant products	200	
Mammals—skins and food	500	
Value of shore birds to crops.....	30,000	
Total	—	\$58,500

Recreation

Park value to a town of 10,000 (based on expenditure of cities)	\$30,000	
Sportsman's value (interest on \$100,000 invested in boats and cottages).....	5,000	
Net profits to community from recreation visitors.....	10,000	
Total	—	45,000

Water Conservation

Water-storage value as insurance against floods and extreme low water, as a protection against loss to fisheries, water power, recreation, and navigation downstream	\$30,000	30,000
		<hr/>
		\$133,500

A study of the literature of the subjects concerned, cited on the preceding pages, will show that the figures assigned are not unreasonable. Might a community of 10,000 to destroy the food and recreation values (103,500) of the lake to the extent of 40 to 80 per cent in order to save \$30,000 annual expense for treating sewage and industrial wastes? The answer is obviously No. Should three-fourths of the 40 square miles be converted into farms at an expense for ditching and diking of \$1,000,000, including title, and the land sold at a profit of \$1,000,000? The land might produce \$500,000 worth of food each year, with the complete destruction of \$133,000 value, leaving \$367,000 to cover increased cost of labor in cultivation and interest on investment, but perhaps nothing more. However, the increase in food production is highly desirable. The dangers to the downstream inhabitants from floods and drought, which increase as population increases, constitute not merely a monetary loss, but the maintenance of stream flow is a moral obligation growing with the population.

Then why does such drainage take place? It is primarily because certain rights to land based on English common law have become established, and the interest of the owners lies in profits and dividends rather than in a consideration of the general good. The interest of sanitary engineers, users of water power, navigators, sportsmen, fishermen, in fact all concerned in maintaining a steady flowing stream (both floods and extreme low water are dangerous) points to the development of aquiculture in lakes and marshes connected with important streams. Before much progress can be made, both research and legislation are necessary. Our laws relative to riparian rights, like those of England which caused the destruction of the salmon in the Mersey, do not make possible the application of the best measures for the general good to marshes and streams and their margins. The laws should be improved, and campaigns of education should be inaugurated.

Above all, there is need of putting existing aquatic resources on a permanent basis. There has been too much fish "mining," mussel "mining," i. e. too much of the tendency to take all and go to the next place or the next product, and not enough "farming" of these resources. Why, with all our immense rivers, should we import mussels from China? Is it not better to work out a basis for a permanent supply from our own waters? Here research is necessary; as yet we know little or nothing about what portion of the individuals of any species can be safely removed each year and leave a permanent supply under the best conditions we can devise.

THE NIAGARA CUESTA FROM A NEW VIEWPOINT

By A. W. GRABAU

The generally accepted explanation of the origin of the Niagara Escarpment, or Cuesta, and that of the other cuestas which parallel it and which form such significant features in the physiographic history of the eastern United States, is by now familiar to all students of earth forms and their genesis. Outlined originally, in its fundamental features, by William Morris Davis, it has always formed one of the most satisfying examples of land forms produced by the activities of the agents of erosion in a region of simple structure and normal alternation of resistant and weak strata. This conception of the origin of these escarpments has thrown a flood of light upon the early history of the valleys now occupied by the Great Lakes and has furnished a key to the rational analysis of the rather complicated arrangement of many of our old and partially abandoned stream valleys, not only in New York state but also in the adjoining districts. As in the case of all great generalizations, however, prolonged study and discussion of the problems involved has led to amplification and, to a certain extent, modification of the original conception, and in this Davis himself has taken a leading part. As one who for more than two decades has been actively interested in the physiographic history of eastern North America and especially of the Great Lakes district, I am now impelled to summarize some of the results of my studies which involve a further modification of the interpretation of these escarpments and of the valleys paralleling and transecting them. If this shall result in removing these land forms from the category of the simple belted structure of an ancient coastal plain and make them the type of a geographic structure not heretofore so generally recognized, it can but serve the progress of knowledge.

THE TWO OLDER CONCEPTIONS OF THE ORIGIN OF THE CUESTA AND LOWLAND TOPOGRAPHY OF WESTERN NEW YORK

The original conception of the history of the strata which form the series of east-and-west ridges and lowlands so well displayed in New York state south of Lake Ontario can be gleaned from a perusal of our older textbooks of geology.¹ These strata were held to have been deposited in a sea progressively retreating southward, and the present northern edge of each formation was held to coincide approximately with the northern shore line of the sea in which each was deposited. Davis taught us to realize that the present limits of these strata were primarily produced by prolonged erosion

¹ See, for example, Joseph Le Conte's "Elements of Geology," 4th edit., New York, 1896, p. 309.

and that most, if not all, of the formations involved formerly extended much farther to the north—indeed, that they probably overlapped one another so that the northern portion of each came in turn to rest upon the crystalline rocks which formed the Canadian Oldland, against which these formations were deposited as coastal plain strata in the Paleozoic sea. The two contrasting conceptions just outlined are illustrated in the following diagrams, the first of which indicates the deposits formed in a retreating, the second in an advancing sea, the successive sea levels being indicated in numerical order (Figs. 1 and 2).

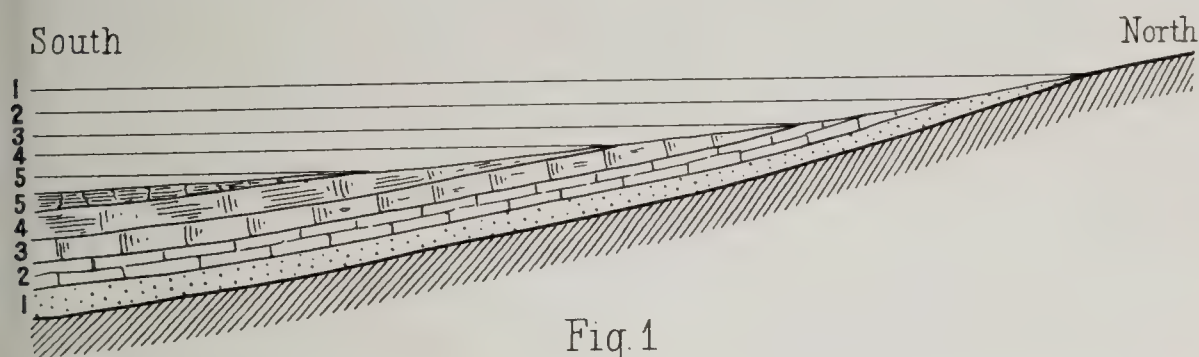


Fig. 1

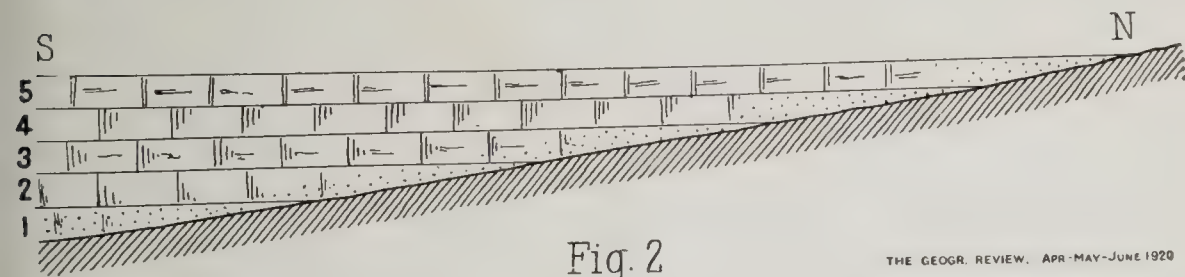


Fig. 2

THE GEOGR. REVIEW. APR.-MAY-JUNE 1920

FIG. 1—Diagram showing the older conception of the order of deposition of the Paleozoic formations in eastern North America. The seashore is regarded as progressively retreating, each later formation being deposited over a smaller area than the preceding. Order of deposition: 1 to 5.

FIG. 2—A newer conception of the mode of deposition of the formations, each younger one overlapping the preceding.

The second interpretation does not necessarily imply such regularity of advance as is suggested by the diagram, for this is intended primarily to illustrate the general conception of a coastal plain series formed in a sea which on the whole was advancing over the oldland, and takes no account of minor irregularities of advance or of intermediate periods of partial retreat, followed by readvance.

From such a relatively simple coastal plain series, fringing an oldland which in part at least supplied the material of the coastal plain deposits, the peculiar cuesta and lowland topography so characteristic of this region was carved upon elevation, by the development of a normal sequential drainage system. The streams of the oldland became extended across the coastal plain and formed the original consequent rivers which began to cut down through the strata approximately at right angles to the original shore lines. The development of subsequent streams, more or less at right angles

to the consequents, began to strip away the portion of the coastal plain which rested against the oldland and so formed the first inner lowland belt. If the surface layer was a stratum of hard rock overlying one of softer material, a cliff was formed which faced this lowland and was separated by it from the oldland on the north. This cliff constituted the "inface" of the first cuesta, which was made up of the remnant of the coastal plain, left after the formation of the first inner lowland (Fig. 3). As the inface of the cuesta retreated under the influence of continued erosion the inner lowland was widened, and as the consequent streams continued to deepen their valleys the subsequent streams were likewise enabled to deepen the inner lowland. If a second hard stratum was discovered beneath the soft one on which the inner lowland was carved, a new cliff or inface came into

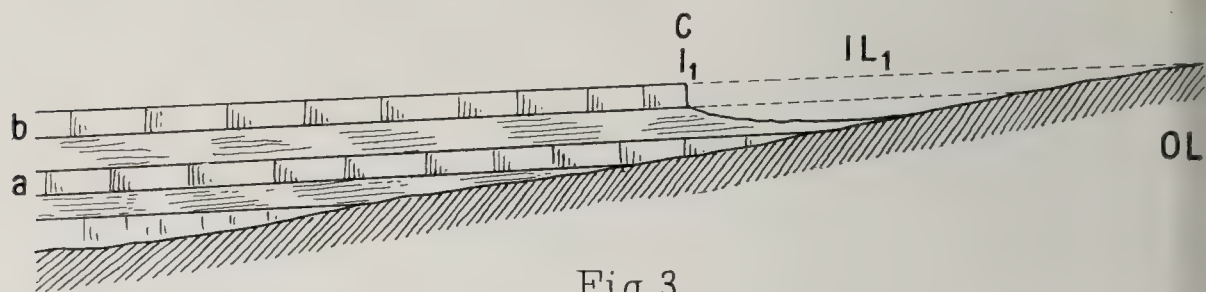


Fig. 3

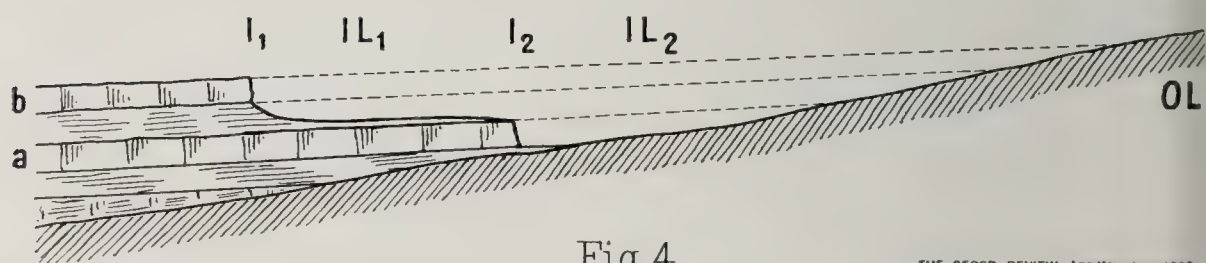


Fig. 4

THE GEOGR. REVIEW, APR-MAY-JUNE 1920.

FIG. 3—Diagram showing early stage of dissection of the coastal plain, with the formation of an inner lowland (IL_1) which separates the inface (I_1) of the first cuesta (C) from the oldland (OL). a, b = hard strata.

FIG. 4—A later stage of dissection of the same coastal plain series. The second hard stratum (a) has been uncovered by the downward cutting of the streams, and a new inface (I_2) has been formed on it, with a new inner lowland (IL_2) between it and the oldland (OL). The first cuesta has been reduced by the seaward pushing, through continued erosion of the inface, and the migration of the first inner lowland (IL_1) in the same direction. As here shown, the two lowlands and cuestas are better regarded as a single terraced cuesta, comparable to the Niagara Cuesta, the lower part of which, seven miles north of the upper, is submerged by the waters of Lake Ontario. If the upper inface (I_1) were pushed by erosion far enough away from the oldland, the outer lowland (IL_1) would come to lie at the level of the inner one (IL_2) because of the dip of the strata.

existence as this second stratum was cut through to another softer one beneath it. Thus a double or twofold cuesta was formed, with two inner lowlands parallel to each other. These two stages are illustrated in the accompanying diagrams (Figs. 3 and 4).

A MODIFICATION OF THE ORIGINAL CONCEPTION

Another modification of this conception, which was held for a time, was in reality a combination of the two explanations of origin primarily given.

This was as follows: After the deposition of the first pair of soft and hard strata, the sea retreated, uncovering a part of the coastal plain, and upon this exposed portion was cut the first lowland faced by the escarpment or inface of the first cuesta. Meanwhile a second series of strata was forming in the still submerged portion of the coast, in part from the material eroded in the making of the first lowland and consequent valleys. When this second coastal plain series emerged, the process was repeated and the second lowland was cut, the second cuesta thus coming into existence. The adjoin-

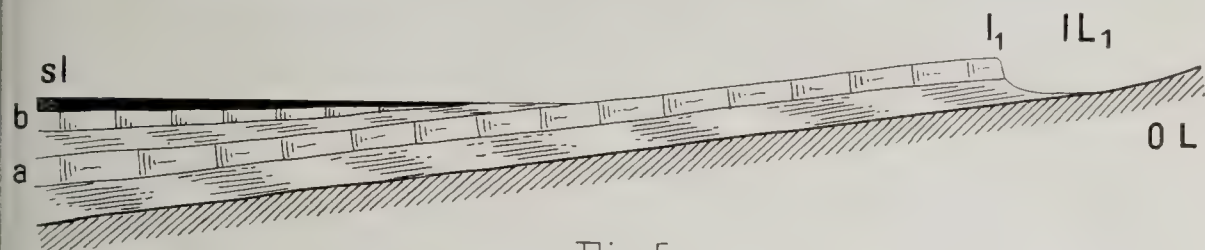


Fig 5

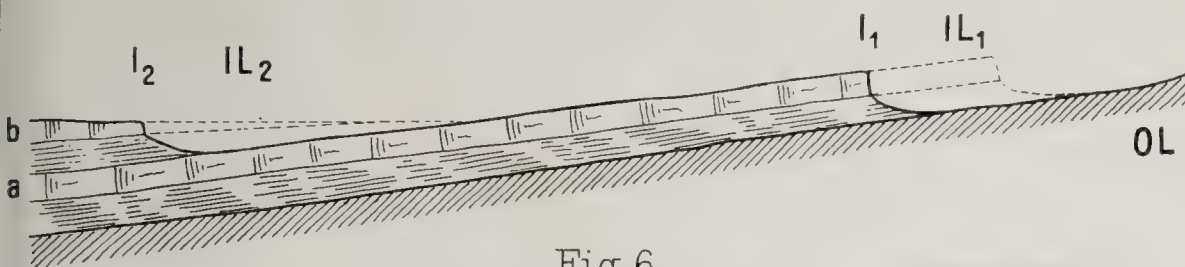


Fig 6

THE GEOLOGICAL REVIEW APR-MAY-JUNE 1920

FIG. 5—Diagram illustrating the conception of the cutting of a cuesta topography and inner lowland on the first set of strata and the simultaneous deposition of a second set of coastal plain strata in the sea. The sea is represented by solid black. a,b=hard strata; I_1 =first inface; IL_1 =first inner lowland; OL=oldland; sl=sea level.

FIG. 6—A later stage of the series illustrated in Fig. 5. The second coastal plain series has emerged, and a new inface has been cut on the upper stratum b, while the inface of the lower stratum has been worn farther back.

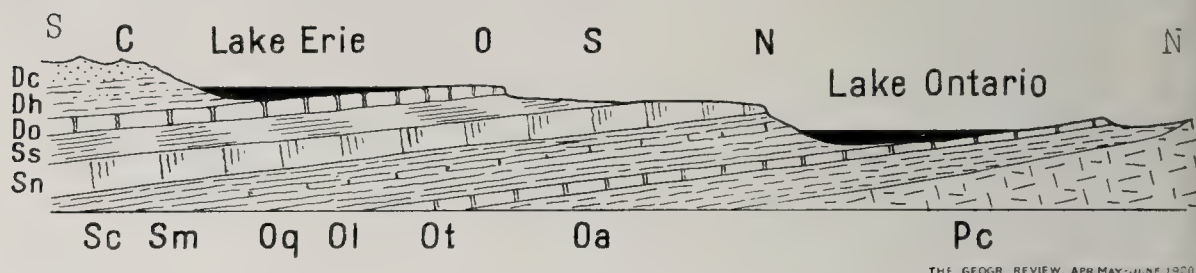
a,b, I_1 , and IL_1 as in Fig. 5. I_2 =second inface; IL_2 =second inner lowland.

ing diagrams (Figs. 5 and 6) illustrate this conception of the course of events. It will be seen that the first inface is cut on the lower stratum (a) and the second on the higher one (b), whereas in the conception illustrated in Figures 3 and 4 the reverse is the case.

THE CUESTAS OF THE EASTERN GREAT LAKES REGION

So far, we have outlined the general theories of the development of coastal plain topography which were applied practically without modification to the ancient coastal plain of New York and adjoining regions as well as to the ancient coastal plain of central England and other districts. A number of cuestas and lowlands have been recognized in the New York region, the first cuesta of any significance, the northern, being that formed on the Ordovician limestones in Canada north of Lake Ontario. The second pronounced cuesta was formed by the Silurian limestones and constitutes

the well-known Niagara Escarpment south of Lake Ontario, this lake occupying the overdeepened second inner lowland. The third cuesta was formed by the Middle Devonian (Onondaga) limestone of western New York, which faces the Salina, or Tonawanda Valley, lowland, one of the prominent east-and-west valleys or lowlands of New York state. Still farther south lies

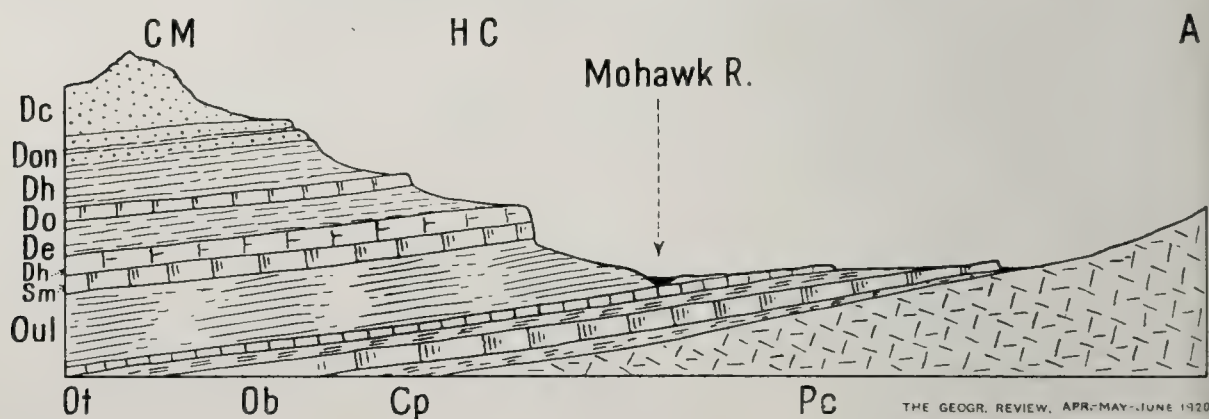


THE GEOGR. REVIEW, APR-MAY-JUNE 1920

FIG. 7—Diagram illustrating the several cuestas and lowlands of western New York and Ontario and the strata from which they were cut.

N=Niagara Cuesta; S=Salina Lowland; O=Onondaga Cuesta; C=Chemung Cuesta. Pc=Pre-Cambrian; Oa=Lower Ordovician shales and limestones; Ot=Trenton limestone; Ol=Lorraine shale, etc.; Oq=Queenston red shale; Sm=Medina shales and sandstones; Sc=Clinton formation; Sn= Niagaran formation (Rochester shale and Lockport limestone); Ss=Salina shales; Do=Onondaga limestone; Dh=Hamilton shales, etc.; Dc=Chemung shales and sandstones. Preceding a small letter, O indicates Ordovician; S, Silurian; D, Devonian.

the fourth cuesta in face formed by the Upper Devonian (Portage and Chemung) sandstones, between which and the Onondaga Cuesta lies the lowland carved on the soft Middle Devonian (Marcellus and Hamilton) shales, the western part of this lowland being occupied by the eastern end of Lake Erie (Fig. 7). Owing to tilting after their formation the southern cuesta



THE GEOGR. REVIEW, APR-MAY-JUNE 1920

FIG. 8—Diagram illustrating the relation of the various strata to the single inner lowland (Mohawk Valley) and the terraced cuesta of the Helderbergs in eastern New York.

A=Adirondacks; HC=Helderberg Cuesta (terraced); CM=Catskill Mountains (monadnock). Pc=Pre-Cambrian crystallines; Cp, Potsdam sandstone; Ot-Ob=Ordovician limestone; Oul=Ordovician shales; Sm=Manlius limestone (Silurian); Dh=Helderberg limestone (Devonian); De=Esopus shale (Devonian); Do=Onondaga limestone; Dh-Don=Devonian shales and sandstones; Dc=Catskill sandstone.

is now much higher than those farther north. Eastward the Upper and Middle Devonian cuestas unite by the change of the Middle Devonian soft beds to harder strata, and so is formed the Helderberg Escarpment south of Altamont, which is further increased in height by the appearance of the

Lower Devonian (Helderberg) limestones beneath the Onondaga. The Salina and Niagara strata die out, and with them disappear the respective lowland and cuesta. The Lake Ontario lowland is continued in the

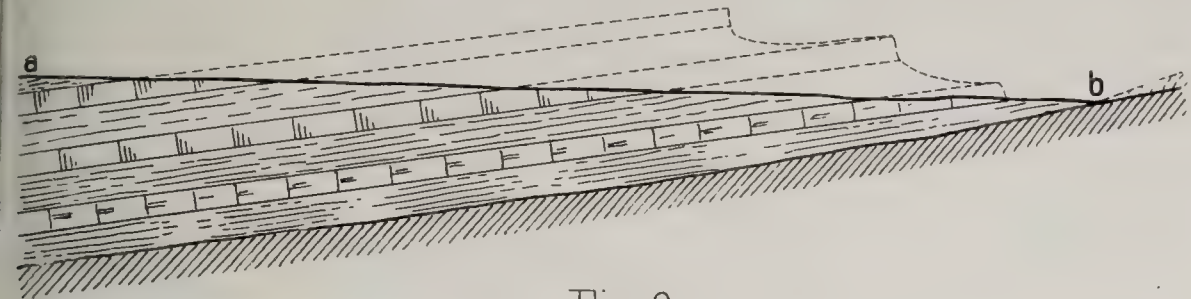


Fig 9

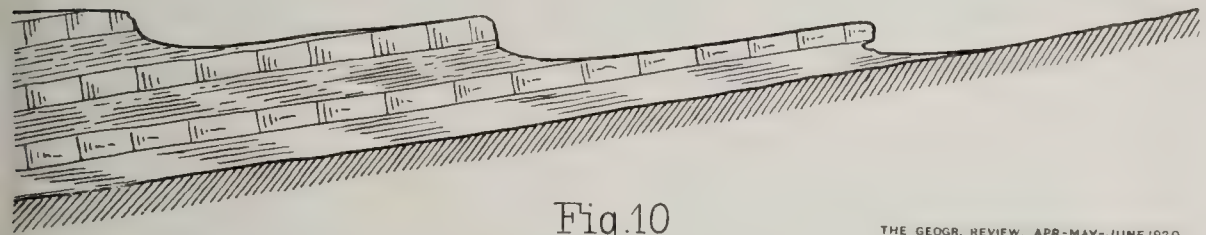


Fig.10

THE GEOGR. REVIEW, APR.-MAY-JUNE 1920

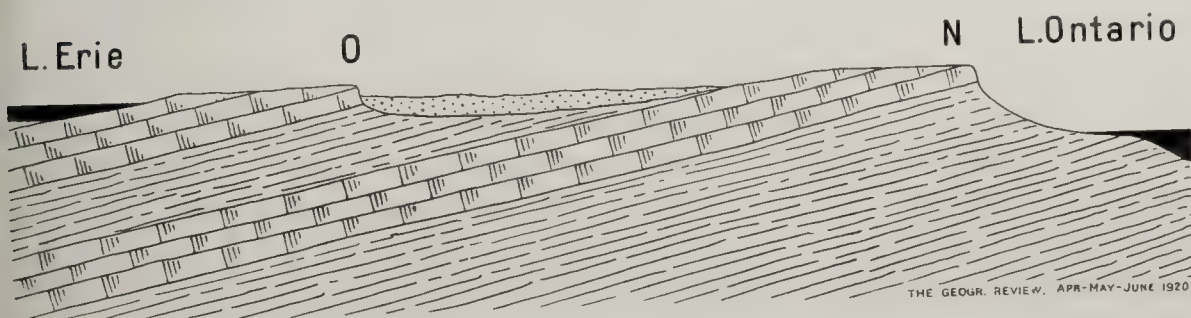
FIG. 9—Diagram illustrating beveling of the old Paleozoic coastal plain strata along the line ab by peneplanation in Mesozoic time.

FIG. 10—Diagram illustrating the formation of cuestas and lowlands on the hard and soft strata respectively by the Tertiary erosion.

Mohawk Valley, which thus lies at the foot of the combined Devonian cuestas on which the lower hard members form terraces. Thus in eastern New York there is only one lowland and one cuesta, which, however, is terraced. This is illustrated in Figure 8.

LATER MODIFICATION IN INTERPRETATION OF PHYSIOGRAPHIC HISTORY OF REGION BROUGHT ABOUT BY RECOGNITION OF PENEPLANATION

We come now to the later modification in the interpretation of the his-



THE GEOGR. REVIEW, APR.-MAY-JUNE 1920

FIG. 11—Diagram showing the thinning of the hard beds on the Niagara (N) and Onondaga (O) cuesta edges, due to beveling of the hard strata during the peneplanation of the region.

tory of these topographic features and the change of opinion which came about by the recognition of the peneplanation of the region before the

development of the present river valleys and lowlands. Instead of considering that the region illustrates a succession of coastal plains on which the belted topography was developed or a succession of cuestas and lowland developed as the result of the progressive uncovering of successively lower hard members in a single coastal plain, we now recognize that the present topography does not represent the first cycle of erosion but the last of an unknown number of cycles. We now recognize that all these strata were beveled across by the development of the Cretaceous peneplain, and that the successive lowlands were carved on the softer strata by the rivers of Tertiary time. This is illustrated in diagrammatic form in Figures 9 and 10.

This explanation involves only a minimum amount of retreat of the escarpments or infaces of the cuestas, which are on the whole very near the northern edge of the outcrops of the strata at the time of the completion of the peneplain. This is shown by the facts that only the lower parts of

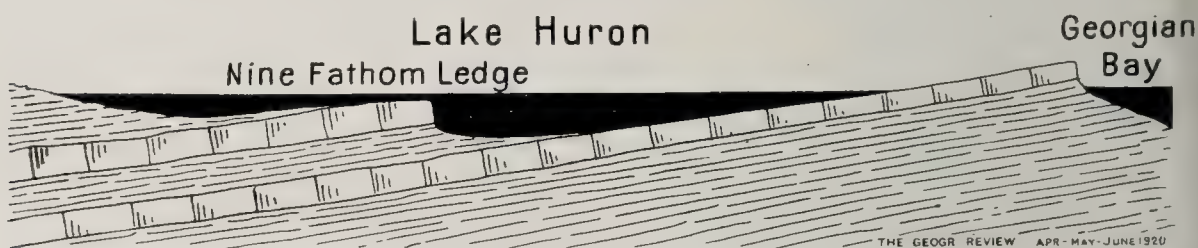


FIG. 12—Section through Lake Huron, from Saginaw, Mich., to Georgian Bay, showing the submerged (Onondaga) escarpment at Nine Fathom Ledge and the prominent Niagara Escarpment which faces Georgian Bay.

the hard formations are involved in the cliffs or infaces of the cuestas, the hard beds themselves having been beveled across. Thus in the Niagara Escarpment only the lower 25 feet of the Niagaran (Lockport) limestone is shown, the total thickness of which south of the falls is nearly 200 feet. At North Buffalo, where the Onondaga Escarpment is partly obscured by drift, only 30 or 40 feet of this formation remains, this being the lower part of the limestone which south of Buffalo retains its full thickness of over 150 feet. These features are graphically shown in Figure 11.

Though of little topographic significance at Buffalo, on account of obscuration by glacial drift, the Onondaga Escarpment becomes a prominent feature where it crosses diagonally through Lake Huron from north of Goderich, Ont., to Mackinac (for locations see map, Fig. 17), having a height of over 400 feet, although it is entirely submerged by the lake waters, as shown in the diagrammatic section (Fig. 12).

THE WRITER'S SUGGESTED MODIFICATIONS OF PRESENT VIEWPOINT

Thus far I have presented the views of the origin and relations of these

uestas and lowlands generally held with more or less modification at the present time, and I now wish to present the modifications which further study of the problem seems to me to demand.

DERIVATION OF ANCIENT COASTAL PLAIN MATERIAL FROM APPALACHIA
AND NOT FROM THE CANADIAN OLDLAND

In the first place, our conception of the formations involved, as representing coastal plain strata deposited against and over the Canadian Oldland, requires to be revised. By definition the strata of a coastal plain are deposited upon and against an older, partly submerged land mass, the emerged part of which constitutes the "oldland" at the time of the deposition of the coastal plain strata beneath the sea or at its margin. Subsequent elevation brings a part of the coastal plain strata above the level of the sea, and this constitutes the coastal plain.

A critical examination of the Paleozoic strata of eastern North America leads to the conclusion that the oldland from which the fragmental material of these strata was derived was not the Canadian mass but a now vanished continent (Appalachia) which lay in the region of, and to the east of, the present Atlantic coast, a fact long known to geologists and physiographers. The strata involved in the folds of the Appalachian Mountains represent the nearshore ends of the formations which are now exposed in the edges of the escarpments in the belted country of New York, Michigan, and Wisconsin. The Canadian region lay a thousand miles or more from this shore, and there is now abundant evidence to show that, during a part of the time at least, it was completely submerged, forming a distant though comparatively shallow sea bottom. That the Ordovician, Silurian, and part of the Devonian beds extended entirely across the present crystalline surface of Ontario not only is shown by the presence of remnants of some of these strata upon this surface (as at Lake Temiscaming) and by the presence of most of them in the region to the north of the crystalline area in James Bay but also is a necessary inference demanded by the character of the strata and their faunas. I believe it is a sound conclusion generally held by paleogeographers that such formations as the Niagaran, for example, extended entirely across Ontario from the present Niagara Escarpment to the James Bay region and beyond to the Arctic. Here was for the most part a broad though shallow sea in Silurian time in which the coral reefs of that period were building, and, though here and there may have been islands of older rock and even peninsular extension of some land masses, yet on the whole this was a region of open sea, for here the limestones had their maximum thickness and their greatest purity. The fragmental beds which are still recognizable in New York as shales and sandstones have mostly thinned away in this more distant region by merging into the limestones.

THE ONTARIO DOME PART OF THE UP-DOMED SEA BOTTOM AND NOT THE PALEOZOIC OLDLAND

At a subsequent period in the history of the region, the Ontario area was elevated into a low dome, one of the numerous domes formed at the end of Paleozoic time in eastern North America. During the Mesozoic era this dome was peneplained, with the result that all the covering strata were removed from the center of the dome, exposing the old crystallines, which during much of Paleozoic time formed a deeply buried sea floor. These crystallines are therefore a part of the up-domed sea bottom and not the oldland of Paleozoic time, and the Paleozoic strata on its flanks are merely the edges of beds which once extended entirely across them. On these rimming remnants of sea-bottom deposits the present cuesta and lowland topography was carved, much as the rimming series of hogbacks and concentric lowlands were carved on the edges of the strata exposed after the

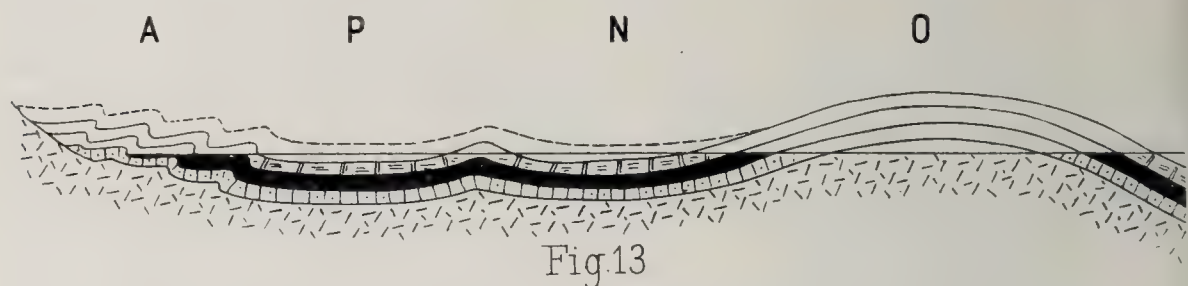


Fig.13

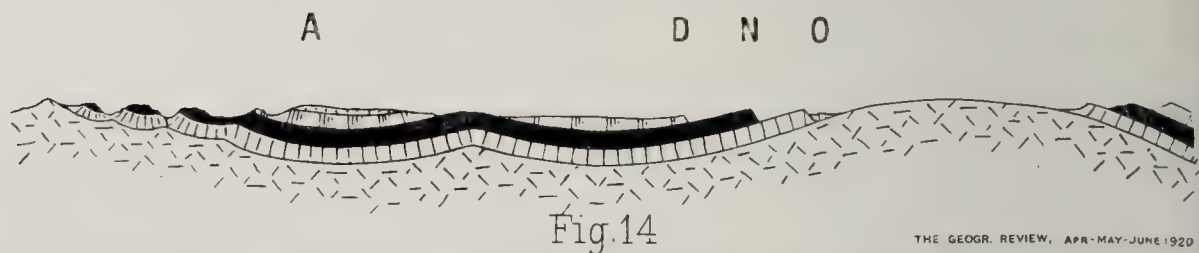


Fig.14

THE GEOGR. REVIEW, APR-MAY-JUNE 1920

FIG. 13—Diagram illustrating the folded Appalachian strata in the coastal plain region and the basining and doming in the region away from the shore.

A=Appalachian folds and Oldland; P=Pennsylvania Basin; N=New York Basin; O=Ontario Dome. The Ordovician, Silurian (black), and Devonian formations are shown. The Carboniferous is indicated by dotted lines. The Appalachian folds probably did not appear as such on the surface.

FIG. 14—Generalized diagram illustrating the formation of the cuesta and lowland topography on the borders of the Ontario Dome.

O=Ordovician cuestas; N=Niagara (Silurian) Cuesta; D=Devonian cuestas; A=Alleghany Plateau.

erosion of the Black Hills dome, only that there the strata are more steeply inclined. The accompanying diagrams, Figures 13 and 14, illustrate these features.

RADIAL ARRANGEMENT OF DRAINAGE AS EVIDENCE OF UPLIFT OF ONTARIO DOME IN TERTIARY TIME

A further fact must, however, be noted. There is evidence that this

Ontario Dome suffered a renewed though slight elevation in early Tertiary time, for the consequent rivers which initiated the new drainage system had roughly radial arrangement. This is excellently shown in the arrangement of the Finger Lake valleys of New York, an arrangement frequently noted and commented upon. For it is now recognized that these valleys were originally formed by consequent streams flowing from the north, though nearly all of them have subsequently been deepened by glacial erosion. A glance at the map (Fig. 15) shows this radial arrangement at once, and further comment is unnecessary. There are, however, a number of buried valleys which are not so easily recognized in the present topography but which readily take their place in the radial series of these consequent streams, which flowed from the rejuvenated Ontario Dome. The broad valley now occupied by the Genesee River from Rochester south to Mt. Morris is one of these. This continues as a pronounced open valley southward to Dansville, beyond which it can be followed without difficulty, though somewhat obscured by drift, to the Susquehanna drainage system. This valley has been greatly deepened by glacial erosion as far as Dansville, but south of that it retains its preglacial character except for a moderate amount of drift filling. A second parallel valley, lying farther to the west,

is occupied by the modern Genesee from Portage southward, and the northward extension of this valley can likewise be traced with considerable accuracy. An even larger valley, which appears to have been cut by the main consequent stream from the Ontario Dome, is that of the ancient Dundas River (map, Fig. 16), which ran southwestward through the western end of Lake Ontario and was a member of the Mississippi

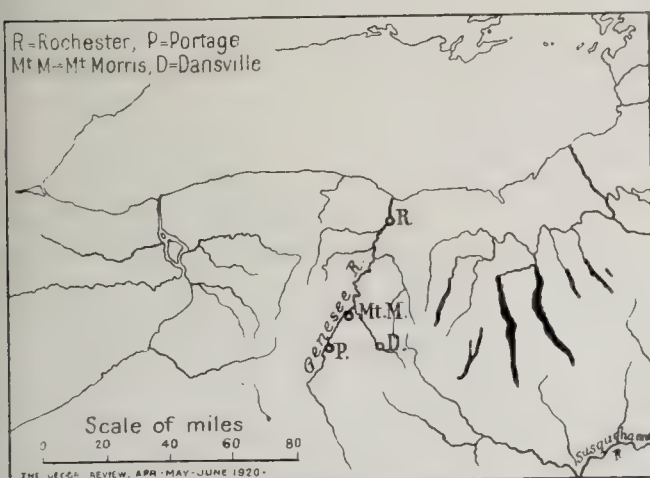


FIG. 15—Map showing (in solid black) the arrangement of the Finger Lake valleys in New York state.

drainage system. The valley of this stream is largely obscured by drift, but where it cuts the Niagara Cuesta, near Hamilton, Ontario, its width is nearly three miles. Finally, there is sufficient indication that a large river, flowing more nearly westward from the old Ontario Dome, cut the broad and deep notch through the Niagara Cuesta which now connects Georgian Bay and Lake Huron. This river was apparently responsible for the formation of the valley of Saginaw Bay, and it has been traced through borings at least as far as central Michigan.

We thus clearly perceive the radial arrangement of the Tertiary stream

valleys around a part of the old Ontario Dome, from the southeastern slope where the valleys have a distinct southeasterly direction, to the western side where the ancient valleys, now largely obscured by drift or submerged beneath the lake waters, have a marked westward trend. The tracing of other valleys farther east on the Ontario Dome is rendered difficult by the fact that here a second dome, the Adirondack, with its own drainage system, existed. Southwest of the Ontario Dome lies the Michigan Basin, and northwest of that the Wisconsin Dome. Thus in this region, too, the drainage was complicated by other drainage systems. The old drainage valleys on the north of the Ontario Dome have not been located, but when this region is more fully explored their existence will doubtless be shown.

The general character and direction of the Tertiary valleys on the known southern and western sides of the Ontario Dome are, however, quite sufficient to establish the fact that the Tertiary drainage system of this region was a radial one, and this can in my view be explained only on the basis of a renewed, though relatively slight, uplift of the Ontario Dome in Tertiary time. With the entrenchment of these radial consequents beneath the surface of the old peneplain, the possibility for the formation of rimming lowlands on the softer strata was developed, and in this process of lowland cutting the escarpment or cuesta infaces came into existence on the harder strata.

DEVELOPMENT OF THE DRAINAGE SYSTEM IN THE EASTERN GREAT LAKES REGION IN TERTIARY TIME

The most pronounced of the inner lowlands thus formed is the one now occupied by Lake Ontario. This valley was continued northwestward in the valley partly filled by the waters of Georgian Bay. The former connection between these two valleys is now filled by drift deposits, but a sufficient number of borings is known to prove such a connection. The valley of Georgian Bay was originally cut by streams tributary to the Saginaw River, and on the same soft Ordovician shales on which the Ontario Valley was carved by streams tributary to the Dundas River. The floor of the Georgian Bay Valley is, however, about two hundred feet lower than the lowest point in the now submerged floor of the gap which the Saginaw River cut through the Niagara Cuesta, and this indicates that at a later stage in the development of these river systems the headwaters of the Saginaw were captured by a branch of a more powerful stream working on the soft strata. This master stream was the Dundas River, the northwestern tributary of which, working along the base of the Niagara Cuesta in Canada, finally diverted the upper portion of the Saginaw drainage system into that of the Dundas. An eastern arm of this same master stream successively captured the headwaters of the southward- and southeastward-draining consequent from the Ontario Dome and thereafter deepened its valley to such an extent on the soft shales that the floor of this subsequent valley now lies in places nearly

thousand feet lower than that of the beheaded consequents whose valleys we now trace in the Finger Lakes and in the several valleys of the Genesee country. Thus was developed the deep and broad valley of Lake Ontario, the rivers of which became tributary to the ancient Dundas drainage system, while the beheaded stream valleys of the other consequents—the Finger

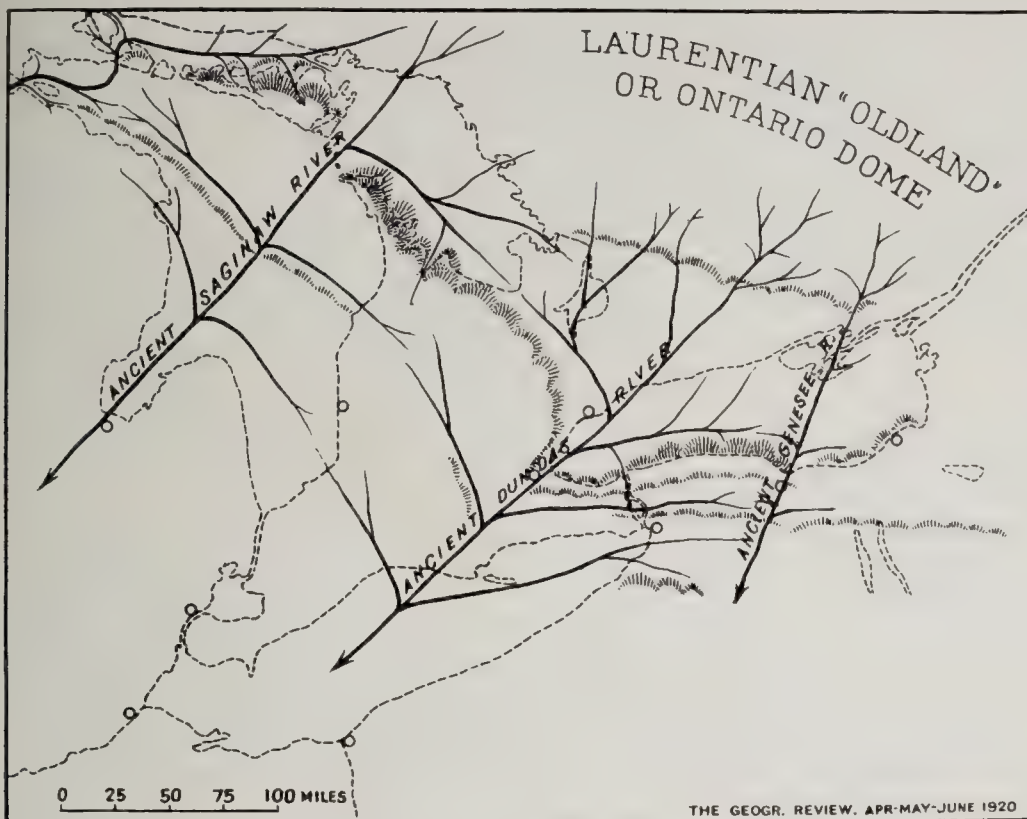


FIG. 16—Generalized map showing restoration of the drainage systems existing in early Tertiary time in the Ontario Dome region with their radial arrangement. (After Fig. 5, "Guide to the Geology and Paleontology of Niagara Falls and Vicinity," by A. W. Grabau, *New York State Museum Bull. No. 45*, Albany, 1901.)

Lake series—now end in the air at the edge of the Niagara Escarpment. In the accompanying two maps (Figs. 16 and 17) these steps in the development of the drainage system are shown.

FINAL STAGE IN THE DEVELOPMENT OF THE MODERN DRAINAGE SYSTEM

The final stage in the development of the modern drainage system was inaugurated by the overdeepening of most of the north-south valleys by the ice during the succeeding glacial periods and was completed by the deposition of heavy moraines within these old valleys, for the most part to the south of the overdeepened portion. The ancient outlet of the Ontario drainage system, the Dundas Valley, was completely blocked by drift, as were also portions of the Ontario-Georgian Bay lowland in the region flanking the Dundas Valley. Finally, the fact, apparent on the disappearance of the ice, that the entire region surrounding the Ontario as well as the Adirondack Dome had been depressed to a considerable amount during the occu-

pancy of this region by the ice induced a reversal in direction of the stream which reoccupied the old valleys, and thus the entirely abnormal St. Law

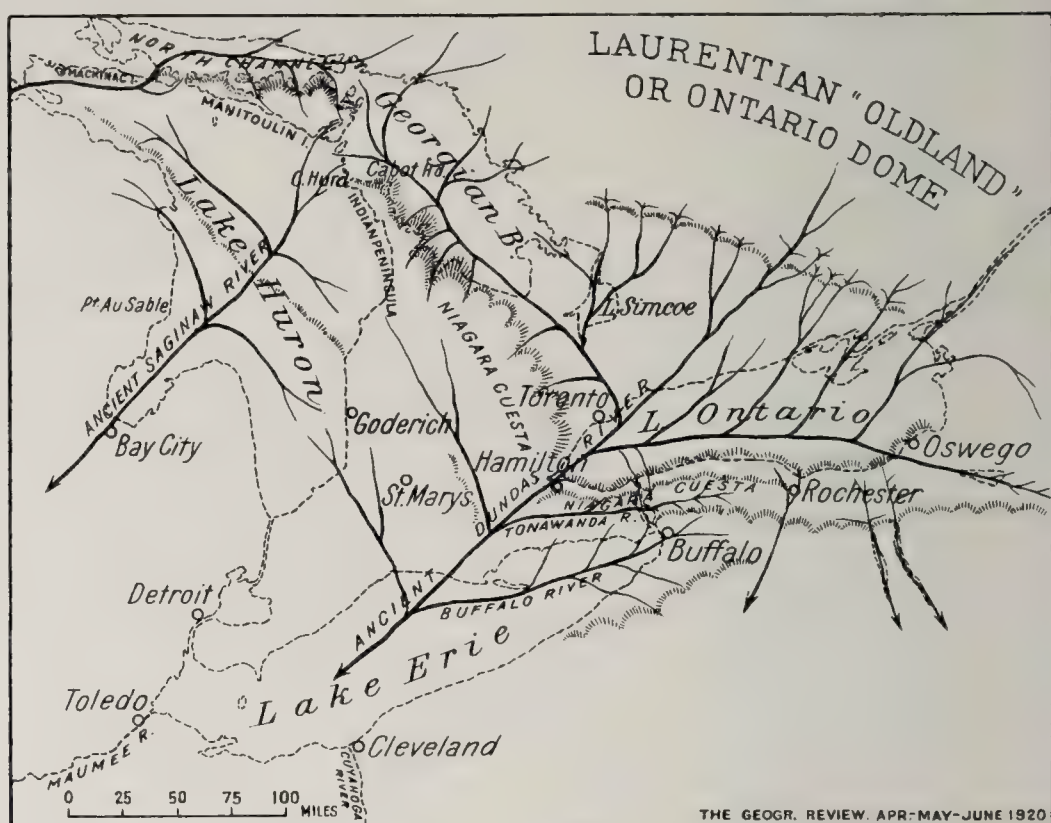


FIG. 17—Generalized map showing a probable later stage of the Tertiary rivers of the Ontario Dome with their capture and adjustment to the strata as suggested by the existing relief features. (After Fig. 6, *New York State Museum Bull. No. 45.*)

rence drainage system came into existence. If the Ontario and Adirondack Domes region were raised a thousand feet or more and if the obstructing drift were removed from the old valleys, the original southward drainage would become re-established. Along the lines of many of these ancient consequent streams, however, lakes would be formed, these occupying the over-deepened portions of the valleys, such as those of the Finger Lake valleys of New York. The St. Lawrence would again head in the Thousand Islands region, where would also originate a southwestward-flowing stream, tributary to the Ontario and Dundas Rivers. The Mohawk divide at Little Falls would become re-established, the western stream from this divide joining the Ontario River, while the eastern stream would continue to the Hudson as does the Mohawk today. This shortened Mohawk and the revived stream from the Lake Champlain region would re-establish the subsequent drainage system which was formed around the southern and eastern margins of the Adirondack Dome in Tertiary time. In relation to this system the Hudson has at least a partial consequent habit.

THE PRE-WAR COMMERCE AND THE COMMERCIAL APPROACHES OF THE BALKAN PENINSULA*

By CLIVE DAY
Yale University

The purpose of this paper is to present, with some approach to accuracy, the general characteristics of the commerce of the Balkan Peninsula. The student of the problems of the separate states finds himself, inevitably, drawing comparisons between them and seeking a broader basis for his study than the conditions of a single country afford him. He recognizes a general problem underlying the varied national questions. He demands a survey of the whole. The demand is reasonable and should be given more consideration than it has yet received, although, as will appear, it can be satisfied only in part.

THE FIELD COVERED IN THIS SURVEY

The investigator who seeks to treat the commerce of the Balkan Peninsula as a whole finds serious gaps in the commercial statistics on which his work must be based. The figures of Turkish commerce were thoroughly unreliable before 1910, when a new system of determining values and quantities by declaration went into effect.¹ Even after that date the figures are given in such a form as to render difficult the distinction of European and Asiatic total trade and to make impracticable the distinction of individual items in the European trade. The total imports of Turkey in Europe in 1910 exceeded those of any other country in the peninsula and made up about one-third of the total imports of all Balkan countries: the exports were much less important, composing less than one-fifth of the total.² Unfortunately the form in which the Turkish figures are supplied

* Read at the joint meeting of the Association of American Geographers and the American Geographical Society at New York, April 16-17, 1920.

¹An account of the change is given in British *Diplomatic and Consular Repts., Ann. Ser. No. 4835* [Cd. 6005-8] and No. 5045 [Cd. 6665-3]. Figures of Turkish trade cited in the text are taken from "Turkey: Report for the Year 1912 on the Trade of the Consular District of Constantinople," *Diplomatic and Consular Repts., Ann. Ser. No. 5045* [Cd. 6665-3], London, 1913.

²The trade of European Turkey in 1910, from the figures of the British report reduced to round millions of francs, was as follows:

	IMPORTS	EXPORTS
Adriatic ports	21	13
Saloniki	103	24
Kavala, Üsküb, etc.....	22	14
Dedeagach.....	14	6
Adrianople, Porto Lagos, etc.....	20	9
Constantinople, Stambul, Galata.....	306	50
Total	486	116

To this should be added an estimate of the trade of the European ports of the Sea of Marmara and, a much more important item, trade subject to the Public Debt Administration and to the Imperial Tobacco Régie. Exports under this last head amounted, for the whole empire, to about 75,000,000 francs.

makes it impossible to include them in the detailed analysis on which this paper is based.

The northwestern part of the peninsula must also be omitted from the survey. Material exists on which rough estimates of the trade of Dalmatia could be framed, and relatively good commercial statistics are supplied for Bosnia and Hercegovina,³ but it does not appear profitable to attempt to include either these districts or the independent state of Montenegro, whose commerce is relatively insignificant, in the comparison.

METHOD EMPLOYED IN COMPILATION OF STATISTICS

The conclusions of this paper, therefore, are based on the commercial statistics of four countries of the Balkans: Rumania, Bulgaria, Serbia, and Greece. These statistics, compiled in a form suited to a summary survey, are presented in Tables I-VIII. They relate to the years 1910 and 1911, giving an average of the two years. The period covered seems now far distant, but is actually the most recent period in which peace prevailed and in which normal commercial relations can be studied.

It is difficult to group together, for the purpose of a survey, the commercial statistics of the four separate countries, and I have simplified the process, at the expense of ideal accuracy, by treating only the principal items of import and export. Differences of classification and of nomenclature in the statistics of the separate countries, together with the overwhelming detail of the primary statistical sources, make it impracticable for the private investigator to fuse all the different figures into one mass and then recast the unified statistics according to the plan which appears to him to bring out best their significance. I have chosen five groups—agricultural products, animal products, forest products, minerals, and manufactures—and have classified the principal items under those heads. The sum of these items amounts to about 70 per cent of the value of the total imports and approaches 90 per cent of the value of the total exports. The remaining items are great in number but of little importance taken separately; these items are not distinguished in my analysis.

In the years named the total trade, combining imports and exports, of the four leading countries was valued at about 2,000,000,000 francs a year, considerably less than one per cent of the total trade of the world. These

³ These are published by the Landesregierung, Sarajevo, and, after the delay of some years, are summarized in *Oesterreichische Statistik*. Fortunately an article by Dr. A. Korompay, published in the *Austrian Statistische Monatschrift*, Vol. 40, 1914, Vienna, just before the outbreak of the war, gives figures for 1910 and 1911. The significant figures for Bosnia and Hercegovina in 1910 are as follows, in millions of Austrian crowns (roughly equivalent to francs):

	IMPORTS	EXPORTS
Raw and semi-manufactured materials,		
for use in industry.....	3	39
for consumption.....	29	51
Manufactured wares.....	113	43
Total.....	145	133

our countries together outranked in commercial importance Portugal or Finland or Norway but counted for less in world trade than Sweden or Spain or even the little country of Denmark.⁴ If the figures for Rumania be excluded, on the ground that that country belongs rather to the Continent than to the Peninsula, the total commerce of the Peninsula would be cut in half.

CHARACTER OF EXPORTS

Considering first the exports of the four Balkan countries named above, the striking feature is the immense preponderance of agriculture over other branches of production (Table II). Agricultural products composed three-fourths of the value of the whole. Animals and animal products (eggs, hides, meat, etc.) when added bring the aggregate farm products, as they may be called, up to four-fifths of the total value of the exports. The products of the forest, the mine, and the factory would at most, therefore, compose one-fifth of the total exports but in fact were probably not much more than half of that. The lumber and the petroleum of Rumania and the mineral ores of Greece are practically the only items in the list worth separate enumeration. I have purposely framed the list so as to include under agriculture those products, like flour and olive oil, which are often classed as manufactures but which seem to me misplaced and misleading when put under that head. Actually the perfume industry of Bulgaria, with its product of attar of roses, appears in my tables as the only export industry of any account under the head of manufactures, contributing six-tenths of one per cent to the total value of the Balkan exports in 1910-1911; a critic might well urge that that industry also, by reason of the primitive character of the equipment and processes employed, ought not to be counted as a manufacture in the usual modern sense.⁵

CHARACTER OF IMPORTS

The reverse of this picture is presented by the table of imports into the Balkan countries (Table IV). Less than one-tenth of the total is composed of those agricultural products sufficiently important to be separately enumerated. The larger part of this sum is composed of the one item of grain imported into Greece, which alone among the Balkan countries has a serious deficiency of this necessary foodstuff. Other items are scattering and relatively unimportant: coffee, sugar, olives, and olive oil.

⁴ See comparative figures in marks in *Statistisches Jahrbuch für das Deutsche Reich*, Vol. 35, 1914, Berlin, Appendix, Table 38.

⁵ A classification different from that employed in the British compilations on which my tables are based would bring other manufactured items into the list of exports. Bulgaria, for example, shows an export of "textile materials and products" somewhat larger in value than the export of perfumery. That part of the export, however, which represents a finished manufacture is made up of coarse woolens such as *chayak* and *abas*, domestic products exported mainly to Turkey; the item of finished cloths is inconsiderable. Cf. *Annuaire Statistique du Royaume de Bulgarie* 1910, Sofia, 1911, pp. 297, 325, 331.

Two points stand out when the agricultural imports of the Balkan countries are analyzed. The first is the non-appearance of raw materials for manufacturing industry. Raw cotton, for example, appears in the list, but as an insignificant item, contributing only about one-third of one per cent of the total value of the imports. The second is the small purchase which

TABLE I — COMMERCE OF BALKAN COUNTRIES, 1910-1911 (Average): EXPORTS *
(Values in thousands of francs)

	Rumania		Bulgaria		Serbia		Greece		All	
AGRICULTURAL PRODUCTS	540,220	.....	104,647	.....	51,058	.....	96,307	.....	792,232	.....
Food										
Grain		522,785		97,736		35,254		48,982		655,775
Fruits						15,804				64,786
Haricots		14,124		4,948						19,072
Tobacco							14,880			14,880
Wine							14,588			14,588
Cognac							2,362			2,362
Olive oil, olives							15,495			15,495
Peas		2,185								2,185
Sugar		1,126								1,126
Colza				1,963						1,963
Raw Material										
ANIMAL PRODUCTS	14,863	.....	24,708	.....	21,689	.....	3,241	.....	64,510	.....
Food										
Animals		5,708		6,206		8,912				20,826
Eggs		3,870		11,241						15,111
Meat						9,194				9,194
Fish		1,329								1,329
Cheese				3,854						3,854
Raw Material										
Hides		2,271		3,407		3,592		2,096		11,366
Wool, raw		1,685								1,685
Sponges							1,145			1,145
FOREST PRODUCTS	24,258	.....	392	.....		.....	1,794	.....	26,444	.....
Wood		24,258		392						24,650
Valonia							1,794			1,794
MINERALS	38,977	.....		.....		.....	18,345	.....	57,322	.....
Petroleum products		38,977								38,977
Mineral ores							18,345			18,345
MANUFACTURES										
Textile			3,247	.....	856	.....			4,103	.....
Wool mfrs.				3,247						3,247
Cordage						856				856
Other										
Perfumes			6,448	6,448					6,448	6,448
TOTAL PRINCIPAL	618,318	.....	139,442	.....	73,612	.....	119,687	.....	951,059	.....
TOTAL EXPORTS...	654,113	.....	156,843	.....	107,707	.....	142,737	.....	1,061,399	.....

* Tables I to VIII compiled by Dr. Grace Fuller, Yale University Library, from tables in *Statistical Abstract for the Principal and Other Foreign Countries* [Cd. 7525], London, 1914, pp. 172-183 and 288-295.

these countries can afford to make of food luxuries like sugar and coffee I have calculated by a rough-and-ready method the consumption of those commodities in the years in question and find that the average inhabitant consumed of coffee less than one pound a year, of sugar about eight pounds. The figures for the United States are almost exactly ten-fold that, for either article.⁶

⁶ I derived the figures from the imports of 1910-1911, corrected only by taking account of the sugar product and export of Rumania. The exceptionally large output of sugar in Rumania, 1910-1911, would, I am sure, more than make up for the omission of the product of the other Balkan states. Cf. *Statistisches Jahrbuch*, Vol. 35, 1914, Appendix, Table 15. American figures are to be found in *Statistical Abstract of the United States*, No. 36, 1913, pp. 671-672, Table 347.

The Balkan countries imported notably small amounts also of the products of animal industry, forestry, and mining. The sum of these imports, of which coal is the chief item, was about the same as that of the agricultural products, about ten per cent of the total.

There is, it will be remembered, in the figures of imports which I have

TABLE II—COMMERCE OF BALKAN COUNTRIES, 1910-1911 (Average): EXPORTS
(Percentage of value)

	Rumania		Bulgaria		Serbia		Greece		All	
AGRICULTURAL PRODUCTS....	82.5	.....	66.5	.....	47.7	.....	67.5	.....	73.97	.....
Food										
Grain and flour....	.....	79.5	.....	62.5	.....	32.9	.....	.....	.....	61.18
Fruits .....	.....		.....		.....	14.75	.....	34.4	.....	6.1
Haricots .....	.....	2.16	.....	3.16	.....		.....		.....	1.79
Tobacco .....	.....		.....		.....		.....	10.4	.....	1.4
Wine .....	.....		.....		.....		.....	10.2	.....	1.37
Cognac .....	.....		.....		.....		.....	1.6	.....	.22
Olive oil, olives....	.....		.....		.....		.....	10.9	.....	1.46
Peas .....	.....	.33	.....		.....		.....		.....	.21
Sugar .....	.....	.17	.....		.....		.....		.....	.06
Colza .....	.....		.....	1.25	.....		.....		.....	.18
Raw Material										
ANIMAL PRODUCTS .	2.27	.....	15.78	.....	20.17	.....	2.26	.....	6.02	.....
Food										
Animals .....	.....	.89	.....	3.96	.....	8.3	.....		.....	1.96
Eggs .....	.....	.59	.....	7.2	.....		.....		.....	1.42
Meat .....	.....		.....		.....	8.57	.....		.....	.86
Fish .....	.....	.2	.....		.....		.....		.....	.12
Cheese .....	.....		.....	2.46	.....		.....		.....	.36
Raw Material										
Hides .....	.....	.35	.....	2.18	.....	3.35	.....	1.47	.....	1.04
Wool, raw.....	.....	.25	.....		.....		.....	.8	.....	.16
Sponges .....	.....		.....		.....		.....		.....	.11
FOREST PRODUCTS ..	3.7	.....	.29	.....		.....	1.25	.....	2.49	.....
Wood .....	.....	3.7	.....	.29	.....		.....	1.25	.....	2.32
Valonia .....	.....		.....		.....		.....		.....	.17
MINERALS	5.95	.....		.....		.....	12.8	.....	5.3	.....
Petroleum products	.....	5.95	.....		.....		.....		.....	3.66
Mineral ores.....	.....		.....		.....		.....	12.8	.....	1.72
MANUFACTURES										
Textile .....	.....		2.3	.....	.8	.....	.....		.39	.....
Wool mfrs.....	.....		2.3	.....		.....	.....			.32
Cordage .....	.....			.....	.8	.....	.....			.08
Other .....	.....		4.25	.....		.....	.....		.6	.....
Perfumes .....	.....		4.25	.....		.....	.....			.6
PERCENTAGE PRINCIPAL	94.5	94.09	89.12	89.55	68.67	68.67	83.81	83.82	89.30	88.87

used an undistributed residuum amounting to 30 per cent of the total value, which would doubtless add considerably to the significance of all these classes if it could be properly apportioned among them. It could not, in any event, so change the balance as to give any one of these classes of imports an importance equal to that of the single class of manufactures, which remains to be considered.

The principal items alone, in the class of manufactured wares, amount to nearly one-half (47.8 per cent) of the total imports. They comprise, of course, a varied assortment, supplied by all the different kinds of factories which have developed in modern industrial regions. To one who is interested in the progress of the Balkans the most hopeful feature appears in

the prominence of the metal manufactures among the imports, amounting to about one-fifth of the total purchases made abroad. If, as is the case the Balkan countries are doing very little as yet to supply their own needs

TABLE III — COMMERCE OF BALKAN COUNTRIES, 1910-1911 (Average): IMPORTS
(Values in thousands of francs)

	Rumania		Bulgaria		Serbia		Greece		All	
AGRICULTURAL PRODUCTS ...	15,220	.....	16,441	.....	3,955	.....	53,295	.....	88,911	.....
Food										
Grain				2,826		1,407		44,026		48,259
Coffee		2,576		2,340		1,310		3,323		9,549
Sugar				5,538		421		3,718		9,677
Olive oil, olives....		5,961		2,399		211				8,571
Fruits		4,696		2,028						6,724
Tobacco		1,987								1,987
Wine						606				606
Raw Material										
Cotton, raw.....				1,310				2,228		3,538
ANIMAL PRODUCTS ..	21,354	.....	5,927	.....	5,300	.....	14,266	.....	46,847	.....
Food										
Fish		5,494						7,166		12,660
Animals		4,575						3,271		7,846
Raw Material										
Hides		5,790		5,927		4,015		3,829		19,561
Wool, wool yarn....		5,495				1,285				6,780
FOREST PRODUCTS ..			6,025	.....	1,082	.....	4,725	.....	11,832	.....
Wood				6,025		1,082		4,725		11,832
MINERALS	7,654	.....	8,414	.....	3,068	.....	19,659	.....	38,795	.....
Coal and coke.....		7,654		4,057				17,390		29,101
Oil, mineral.....				3,263		783		1,085		5,131
Salt				1,094		2,285				3,379
Potash, soda, saltpeter								1,184		1,184
MANUFACTURES										
Textile	126,897	.....	37,105	.....	23,637	.....	17,256	.....	204,895	.....
Cotton yarn.....		24,352		12,570		7,411		956		45,289
Cotton		45,453		16,394		8,810		10,857		81,514
Woolen		32,551		6,089		4,315		4,531		47,486
Silk		16,531						912		17,443
Linen						1,495				1,495
Wearing apparel...		3,400		1,561		1,606				6,567
Hute		4,610								4,610
Cordage and twine.				491						491
Metal	144,168	.....	28,793	.....	22,006	.....	2,743	.....	197,710	.....
Iron and steel.....		70,349		13,871		12,701		2,743		99,664
Other metals.....						3,382				3,382
Machinery		49,187		14,922		5,923				70,032
Vehicles		24,632								24,632
Other	28,758	.....	9,354	.....	10,554	.....	6,718	.....	55,384	.....
Leather, leather manufactures ...		13,022		2,127		2,363				17,512
Chemicals and drugs		8,881				4,182				13,063
Caoutchouc mfrs....		6,855								6,855
Glass, glassware, earthenware				2,375		1,157		1,966		5,498
Paper				3,026		2,650		4,752		10,428
Soap				1,826		202				2,028
TOTAL PRINCIPAL...	344,051	.....	112,059	.....	69,602	.....	118,662	.....	644,374	.....
TOTAL IMPORTS	489,731	.....	188,351	.....	100,061	.....	167,023	.....	945,166	.....

for tools and machinery, they showed at least an appreciation of these needs and an inclination to invest their savings in durable instruments to further their efficiency as producers. If they had been granted ten years of peace since 1910-1911, instead of ten years of war, and had continued to spend

abroad, as they were doing then, some \$40,000,000 a year for metals, tools, and machinery, they would be today in a position very different from that which they actually occupy.

TABLE IV—COMMERCE OF BALKAN COUNTRIES, 1910-1911 (Average): IMPORTS
(Percentage of value)

	Rumania		Bulgaria		Serbia		Greece		All	
AGRICULTURAL PRODUCTS ...	3.1	.....	8.73	.....	4.	.....	31.97	.....	9.8	.....
Food										
Grain				1.48		1.41		26.4		5.26
Coffee .....		.53		1.25		1.3		1.98		1.1
Sugar				3.		.42		2.22		1.2
Olive oil, olives....		1.22		1.3		.21				.9
Fruits .....		.95		1.						.71
Tobacco .....		.4								.24
Wine .....						.6				.06
Raw Material										
Cotton, raw.....				.7				1.37		.37
ANIMAL PRODUCTS	4.3	.....	3.1	.....	5.3	.....	8.56	.....	5.13	.....
Food										
Fish		1.12						4.3		1.33
Animals .....		.93						1.96		.78
Raw Material										
Hides		1.18		3.1		4.		2.3		2.3
Wool, wool yarn...		1.12				1.3				.72
FOREST PRODUCTS		.....	3.2	.....	1.	.....	2.8	.....	1.24	.....
Wood				3.2		1.		2.83		1.24
MINERALS	1.54	.....	4.5	.....	3.	.....	11.7	.....	4.	.....
Coal and coke.....		1.54		2.14				10.4		3.01
Oil, mineral.....				1.76		.78		.65		.54
Salt .....				.58		2.3				.36
Potash, soda, salt-peter								.72		.12
MANUFACTURES		.....		.....		.....		.....		.....
Textile	25.76	.....	19.	.....	23.6	.....	10.4	.....	21.13	.....
Cotton yarn.....		4.95		6.5		7.4		.57		4.8
Cotton		9.3		8.57		8.8		6.5		8.6
Woolen		6.6		3.2		4.3		2.78		4.5
Silk		3.35						.54		1.83
Linen						1.5				.16
Wearing apparel...		.69		.82		1.6				.7
Jute .....		.92								.49
Cordage and twine.				.26						.05
Metal	29.4	.....	15.2	.....	22.	.....	1.7	.....	20.9	.....
Iron and steel....		14.3		7.3		12.7		1.73		10.55
Other metals.....						3.4				.36
Machinery		10.		7.9		5.9				7.4
Vehicles		5.1								2.6
Other	5.9	.....	5.	.....	10.6	.....	4.	.....	5.8	.....
Leather, leather manufactures.....		2.6		1.12		2.4				1.8
Chemicals and drugs		1.9				4.2				1.32
Caoutchouc mfrs....		1.4								.72
Glass, glassware, earthenware				1.25		1.1		1.17		.58
Paper				1.7		2.7		2.85		1.12
Soap .....				.95		.2				.27
TOTAL PRINCIPAL...	69.64	70.1	58.5	59.08	68.7	69.5	70.9	71.27	67.55	68.09

Another group of imported manufactures, about equal in importance to that of the metals, is that of textile products, in which cotton yarn and cloth were the outstanding items. Luxury products, such as silk and linen, were bought in relatively small quantities, and the average inhabitant had but seven cents a year to squander on imported wearing apparel. We may assume, of course, that clothes were made at home, and by like reasoning

we can explain the fact that the average inhabitant spent only two cents a year for imported soap. Unfortunately we cannot make such a liberal allowance for the domestic supply of paper and must note as one of many signs of social backwardness that the average inhabitant spent but twelve

TABLE V—COMMERCE OF BALKAN COUNTRIES, 1910-1911 (Average): IMPORTS FROM OTHER COUNTRIES
(Values in thousands of francs)

FROM	INTO				
	Rumania	Bulgaria	Serbia	Greece	All
Austria-Hungary	117,510	47,893	31,798	21,702	218,903
Germany	161,017	36,978	33,162	13,648	244,805
United Kingdom.....	71,186	26,358	10,474	37,676	145,694
France	30,494	20,138	4,675	10,151	65,458
Belgium	21,048	6,777	1,491	3,028	32,344
Netherlands	5,312	2,005	634	3,832	11,783
Italy	25,168	7,981	4,253	6,665	44,067
Russia	12,656	6,920	2,608	35,245	57,429
Rumania .....	.....	7,648	1,359	2,616	11,623
Bulgaria	1,366	.....	590	10,910	12,866
Serbia	381	2,010	.....	.....	2,391
Greece	1,834	454	356	.....	2,644
Bosnia .....	.....	.....	214	.....	214
Montenegro .....	.....	.....	57	.....	57
Turkey and Egypt.....	13,951	18,505	4,875	10,950	48,281
Spain	580	.....	.....	.....	580
Norway and Sweden.....	.....	372	.....	.....	372
Switzerland	9,628	1,708	1,760	383	13,479
United States.....	3,258	1,275	1,573	4,177	10,283
Other countries.....	9,341	1,329	182	6,040	16,892
TOTAL.....	489,730	188,351	100,061	167,023	940,165

TABLE VI—COMMERCE OF BALKAN COUNTRIES, 1910-1911 (Average): IMPORTS FROM OTHER COUNTRIES
(Percentage of values)

FROM	INTO				
	Rumania	Bulgaria	Serbia	Greece	All
Austria-Hungary	24.	25.4	31.79	12.95	23.2
Germany	33.	19.5	13.16	8.2	25.9
United Kingdom.....	14.5	13.9	1.05	22.6	15.38
France	6.25	10.6	4.7	6.05	6.95
Belgium	4.3	3.58	.15	1.8	3.42
Netherlands	1.09	1.06	.06	2.29	1.12
Italy	5.15	4.2	4.25	4.	4.65
Russia	2.6	3.66	2.61	21.2	6.15
Rumania .....	.....	4.5	1.36	1.56	1.23
Bulgaria .....	.28	.....	.59	6.51	1.35
Serbia .....	.08	1.06	.....	.....	.25
Greece .....	.37	.24	.36	.....	.28
Bosnia .....	.....	.....	.21	.....	.02
Montenegro .....	.....	.....	.06	.....	.006
Turkey and Egypt.....	2.35	9.8	4.87	6.15	5.1
Spain .....	.12	.....	.....	.....	.06
Norway and Sweden.....	.....	.20	.....	.....	.04
Switzerland	1.96	.9	1.76	.23	1.42
United States.....	1.69	.67	1.57	2.5	1.6
Other countries.....	1.91	.69	.18	3.62	1.8
TOTAL.....	99.65	99.96	68.73	99.66	99.92

cents a year for imported paper of all sorts.

SUMMARY OF BALKAN TRADE

If we attempt now to sum up the character of Balkan trade we may make a composite picture somewhat like the following. The average inhabitant appears as a farmer raising a surplus of food crops which he

markets abroad. This surplus is not very large—almost exactly 61 francs, say \$12.00. To him it is of considerable importance, however, for he has not yet learned to make for himself the conveniences of life which are the product of modern machinery and sends this surplus abroad to buy them. He has some debts to pay, which eat up about \$1.00 of the surplus, leaving

TABLE VII—COMMERCE OF BALKAN COUNTRIES, 1910-1911 (Average): EXPORTS TO OTHER COUNTRIES
(Values in thousands of francs)

To	FROM				
	Rumania	Bulgaria	Serbia	Greece	All
Austria-Hungary	50,079	9,197	33,128	12,588	104,992
Germany	28,645	18,565	25,424	15,730	88,364
United Kingdom.....	44,743	19,776	879	33,431	98,829
France	47,877	10,079	2,516	14,601	75,073
Belgium	244,855	37,367	11,139	9,518	302,879
Netherlands	88,009	1,694	155	10,541	100,399
Italy	59,132	2,883	2,732	9,172	73,919
Russia	6,617	318	34	3,282	10,251
Rumania .....	.....	1,058	6,355	1,071	8,484
Bulgaria	5,668	.....	3,467	.....	9,135
Serbia	737	509	.....	.....	1,246
Greece	851	9,495	110*	.....	10,456
Bosnia .....	.....	.....	116	.....	116
Montenegro .....	.....	.....	17	.....	17
Turkey and Egypt.....	31,573	36,747†	17,728†	16,134	102,182
Spain	4,024	.....	.....	.....	4,024
Switzerland	153	222	158	.....	533
United States.....	254	1,142	.....	11,550	12,946
Other countries.....	40,896	7,791	3,750	5,118	57,555
TOTAL.....	654,113	156,843	107,708	142,736	1,061,400

† Does not include Egypt. * 1911 only; figures for 1910 not given.

TABLE VIII—COMMERCE OF BALKAN COUNTRIES, 1910-1911 (Average): EXPORTS TO OTHER COUNTRIES
(Percentage of value)

To	FROM				
	Rumania	Bulgaria	Serbia	Greece	All
Austria-Hungary	7.65	5.85	30.8	8.8	9.8
Germany	4.4	11.8	23.6	11.	8.3
United Kingdom.....	6.8	12.6	.82	23.4	9.3
France	7.3	6.4	2.32	10.2	7.1
Belgium	37.5	23.8	10.3	6.7	28.2
Netherlands	13.5	1.08	.14	7.39	9.4
Italy	9.	1.83	2.52	6.4	7.
Russia	1.01	.2	.03	2.3	.96
Rumania .....	.....	.66	5.9	.75	.8
Bulgaria .....	.86	.....	3.2	.....	.86
Serbia .....	.11	.35	.....	.12	.12
Greece .....	.13	6.1	.1	.....	.98
Bosnia .....	.....	.....	.108	.....	.01
Montenegro .....	.....	.....	.01	.....	.....
Turkey and Egypt.....	4.8	23.4	15.9	11.2	9.6
Spain .....	.61	.....	.....	.....	.38
Switzerland .....	.02	.14	.15	.....	.04
United States.....	.04	.75	.....	8.07	1.22
Other countries.....	6.25	4.95	3.5	3.58	5.45
TOTAL.....	99.98	99.91	99.398	99.91	99.52

\$11.00 that he lays out on barbed wire, bar iron, shovels, and plows; on calico and canvas; and, to a very modest extent, on some simple table luxuries.

This picture makes more intelligible to my mind some features in the direction of Balkan commercial currents which are striking and which at

first glance appear puzzling. The countries of the peninsula did little business among themselves or with most of their immediate neighbors. They did little business with distant continents. They carried on most of their trade, about three-quarters of the total, with the countries to the north and northwest, of which only one is immediately adjacent.

In this aspect the Balkan country clearly resembles the farmer. Farmers do little trading among themselves. The possessor of a good orchard or of a particular vineyard will find in the neighborhood some sale for his surplus product, but the farming class as a whole looks to the city for its

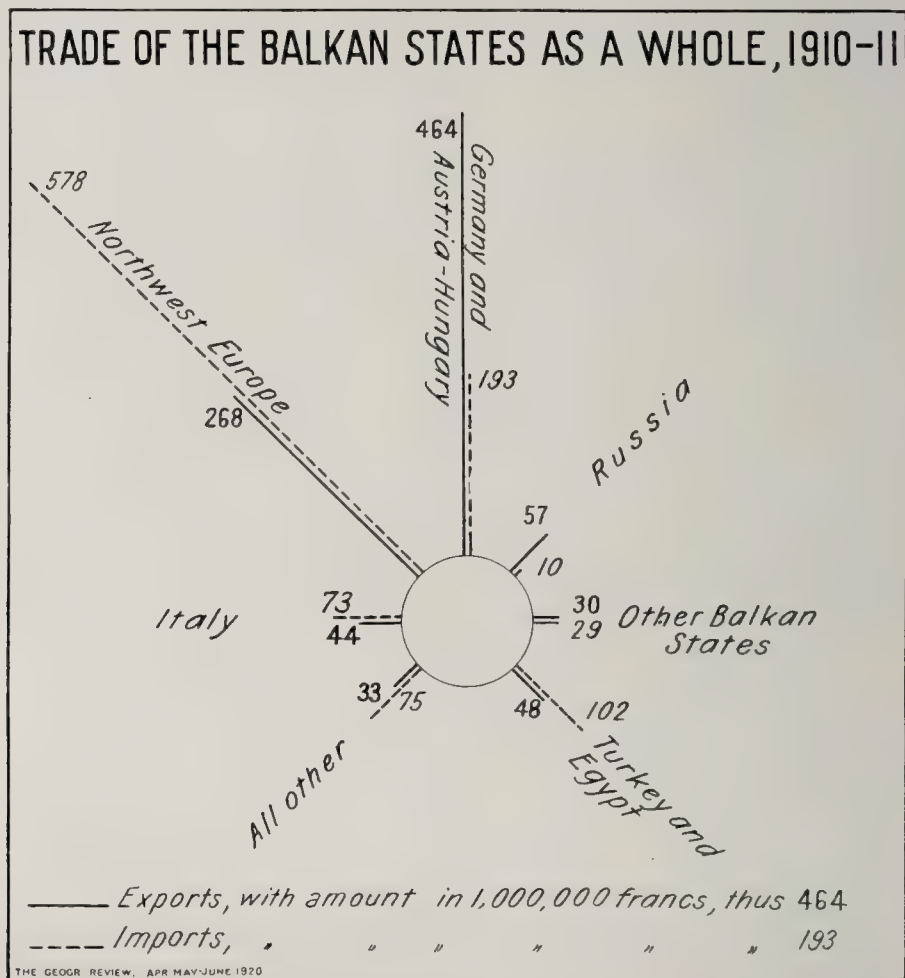


FIG. 1.—Diagram showing the amount and the destination and provenance of the exports and imports of the Balkan states as a whole, 1910-1911. (N. B.: The symbols for exports and imports should be reversed.)

market and its source of supplies. To the Balkan farmer the city is the dense industrial population of northwestern Europe, demanding bread and meat and offering manufactured wares in payment.

Similar considerations help to explain the anomalous distribution of exports and imports along the axes of greatest commercial activity, to the north and northwest. The Balkan exports to northwestern Europe were more than double the imports from that source; the imports from Germany and Austria-Hungary were more than double the exports to that market (Fig. 1). Why is there not a closer approximation to a balance in the

trade with each particular region? As regards exports the answer can be given with some confidence. The British and Belgians and Dutch welcome bread and wheat and are glad to get it from any source. The Germans and Austrians have much farm land of their own and put in the way of food imports obstacles that are sufficient to divert part at least of the trade current of those articles to other countries.

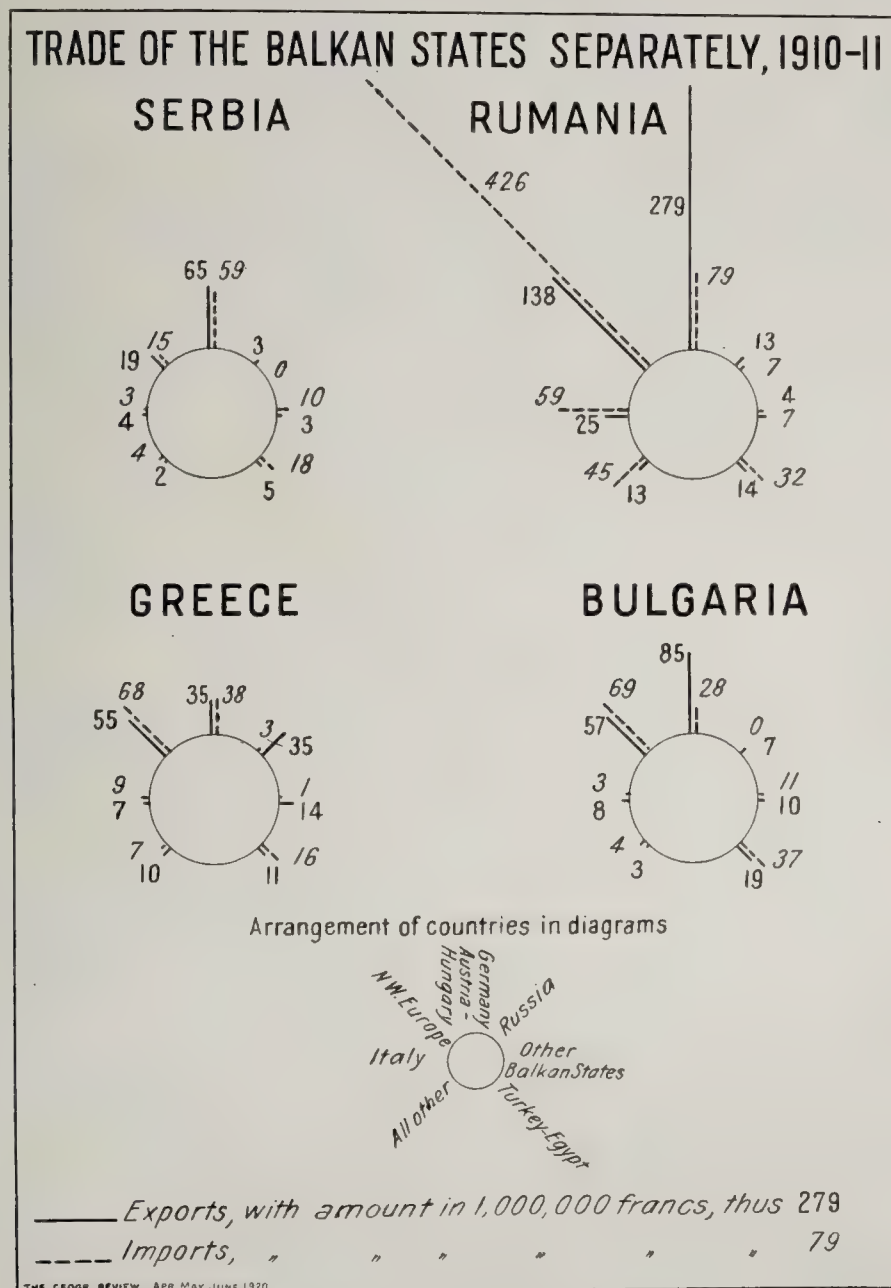


FIG. 2.—Diagram showing the amount and the destination and provenance of the exports and imports of the Balkan states separately, 1910-1911. (N. B.: The symbols for exports and imports should be reversed.)

COUNTRIES TRADED WITH

As regards imports into the Balkans, of which almost exactly one-half come from Germany and Austria-Hungary, the answer is less obvious. These imports are, with negligible exceptions, standard wares, produced by several different countries. Why did not the English or the French or

the Belgians, rather than the German-speaking peoples, supply the goods

They did in fact do so, in large measure, until a comparatively recent period, in which Germany made an astonishing advance. The reasons for the change are intricate, and I shall merely state a personal opinion without seeking to support it in detail. I am inclined, as will appear later, to regard the element of geographical proximity enjoyed by the German-speaking peoples as an advantage in the Balkan market, but one on the whole of secondary importance. It did not give the Germans a commanding position in the Balkans in the past; it will not necessarily assure them such a position in the future.

The Germans have had the trade because they have wanted it more than other peoples wanted it and have gone after it; it did not come to them of itself. Their commercial travelers have explored the region, studied its wants, bestirred themselves to get the right goods, talked business in the language of the country, and offered generous credit. These facts, rather than geographical position or the bluster of commercial policy or superior industrial efficiency, seem to me to explain the hold which the German-speaking peoples had obtained on the Balkan market.

A student of the commercial geography of the Balkan Peninsula desires, of course, to know not only the general character and volume of the trade currents flowing in and out; he would like to distinguish the path of each current and determine the relative importance of the gateways by which trade enters and leaves the peninsula. He finds, however, that the statistical sources of Balkan governments are neither complete nor uniform, and he must be content with the indications given him by the trade of particular countries, inside and outside the peninsula. Fortunately the two countries which have had the largest part in the commerce of the Balkans, Germany and Austria-Hungary (each having about one-sixth), afford means of reaching some preliminary conclusions in the matter.

TRADE WITH AUSTRIA-HUNGARY

Austria-Hungary has been used to distinguish that part of the trade of the monarchy which was carried on by sea, via the Adriatic ports, and

TABLE IX—TRADE OF AUSTRIA-HUNGARY WITH BALKAN COUNTRIES, 1912
(Amounts in millions of crowns)

COUNTRY TRADED WITH	TOTAL IMPORTS	INCLUDING SEA TRADE	PER CENT OF SEA TRADE	TOTAL EXPORTS	INCLUDING SEA TRADE	PER CENT OF SEA TRADE
Serbia	40	0	0	43	0	0
Rumania	102	8	8	134	1	1
Bulgaria	15	1	7	47	4	9
Greece	23	23	100	22	21	95
Turkey in Europe.....	97	78	80	42	34	81
Total.....	277	110	40	288	60	21

**Statistik des auswärtigen Handels*, 1912, Vol. 1, pp. 990, 1052.

urnishes therefore a means of testing the route of the wares exchanged with an immediate neighbor of some of the Balkan states.

Two countries of the Balkans have in the past been at opposite poles as regards the means of commercial approach to them. One, Serbia, lacking any access to the sea, could be reached only by land routes or by internal waterways. The other, Greece, until May, 1916, lacked any railroad connection with the continental lines and therefore was dependent on the sea for practically all its foreign trade. As regards the other states it is apparent that the farther removed they were from Austria-Hungary the more did the greater expense of rail transport, mile for mile, tell in favor of the sea route.

The fact that sea traffic in the export trade had only half the relative importance it showed in importation is due, of course, to the contrast of raw materials and finished manufactures, presenting a great difference in the value of a given bulk.

The smaller part (one-fifth to two-fifths in value) of the commerce of Austria-Hungary with the Balkan states was carried on by sea. We have now to distinguish, if possible, the relative importance of the railroad and of internal waterways in carrying the bulk of the traffic.

HUNGARIAN TRADE

Statistics which would make possible an exact analysis are lacking. It is necessary, in the first place, to omit from consideration the trade of the Kingdom of Hungary with the Balkans. This is not so serious as appears at first, when one thinks of the propinquity of Croatia-Slavonia to Serbia and of Transylvania to Rumania. Actually the trade of the Hungarian half of the monarchy with the Balkan states has been very small. Hungary is too much like the Balkan states in its economic development to give rise to those contrasts in the productive organization from which the gains of trade arise. In the period from 1908 to 1912 it carried on from one per cent to three per cent of its trade with Rumania, from one per cent to two per cent with Bosnia, and only exceptionally as much as one per cent with any other Balkan country.⁷ This situation is intelligible when one reviews the leading imports and exports of Hungary. In order of importance (values), in 1912 the exports were flour, oxen, wheat, hogs, wine, raw sugar, rye, barley, timber, oats, refined sugar; these composed half of the total. These products, in general, compete with Balkan products and would find but a poor market in the peninsula. On the other hand, the imports of the Kingdom of Hungary were mainly manufactured wares (textiles, clothing, leather, shoes) and raw materials like coal, cotton, rice, and coffee; the list is much like the list of imports into a Balkan state.⁸

⁷ *Ungarisches Statistisches Jahrbuch 1912*, Budapest, p. 224.

⁸ *Ibid.*, p. 226 et seqq.

AUSTRIAN TRADE

Even for the Austrian half of the monarchy, however, complete figures are not available. The best that we have are the statistics of the Donau Dampfschiffahrts-Gesellschaft, the most important navigation company operating on the Danube and its tributaries, carrying certainly more than half of the total tonnage, possibly five-sixths.⁹ If we double the figures of the Balkan freight that this company loads and unloads in the Austrian half of the monarchy I believe that we shall have a fair approximation to the total river traffic of Austria-Hungary with Balkan countries, and I have constructed a table (Table X) on the basis, using for comparison the total commercial tonnage of trade, sea-borne and terrestrial, supplied by the commercial statistics. The difference between the figures gives, of course, an approximate idea of the trade carried by the railroads.

TABLE X—TRADE OF AUSTRIA-HUNGARY WITH BALKAN COUNTRIES, 1912 *
(Quantities in thousands of metric tons)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	TOTAL TRADE	RIVER TRADE OF D-D-G.	TOTAL BY RIVER	PER CENT	BY RAIL	PER CENT	BY SEA	PER CENT
IMPORTS FROM								
Serbia	175	19.6	39	22	136	78	0	0
Rumania	776	17.8	36	5	680	88	60	8
Bulgaria	64	7.4	15	23	41	64	8	13
Greece and Turkey.....	199	0.1	0.2	0	28.8	15	170	85
Total.....	1,214	....	90.2	7	885.8	74	238	20
EXPORTS TO								
Serbia	188	37.8	76	40	112	60	0	0
Rumania	516	19.7	39	7	473	92	4	1
Bulgaria	107	15.3	31	29	68	64	8	7
Greece and Turkey.....	137	0.9	2	1	10	7	125	91
Total.....	948	....	148	16	663	70	137	14
TOTAL EXPORTS AND IMPORTS	2,162	....	238.2	11	1,548.8	72	375	17

* Figures for the river trade are taken from *Österreichische Statistische Mitteilungen*, Vol. 7, 1913, p. 86, and refer to the year 1912, as do the figures for total trade and for sea trade taken from *Statistik des auswärtigen Handels*. Figures in column (3) are, of course, mere approximations, and the same must be said of figures under (5), which are remainders obtained by adding the figures under (3), river trade, and (7), sea trade, and subtracting the sum from the figures under (1), total trade. There are obvious objections to fusing statistics of trade and of transportation, as I have done both for Austria-Hungary and for Germany, but no other means appears by which to reach the end desired.

One feature of this table which appears to me to deserve the greatest emphasis is the indication that it gives of the relative unimportance of the Danube as an avenue of access to Balkan trade. That river traverses the heart of Austria and of Hungary; it provides a direct means of approach to three of the Balkan countries, including Rumania, which has by far the greatest commercial importance of all of them. Yet if we view the Balkan trade of Austria-Hungary in the aggregate the river provides a service which is inferior to that of the sea and immensely less than that of the railroad. Suppose the river to be blocked above its confluence with the

⁹Cf. figures in *Oesterreich. Statistisches Handbuch* 1909, p. 344 et seqq.

Save—how serious would be the effect on the Balkan trade of Austria-Hungary? Commerce with Greece and Turkey would follow the sea route, as in the past. The sea and the railroad, between them, would readily provide carriage for most of the remainder of the trade. The districts most injuriously affected, so far as the statistics show, would be Serbia on the Danube, and Bosnia on the Save; in the aggregate they are not of great importance.¹⁰

TRADE WITH GERMANY

Let us consider now, in a similar manner, the trade of Germany with the Balkans. Germany was in the years 1910-1911 the leading country of the world as regards the value of trade with the four Balkan states whose statistics have been analyzed. Germany has not the peculiar advantage of propinquity enjoyed by Austria-Hungary. It does have some advantage of position over the other industrial states of northwestern Europe; it will be interesting to determine how far these advantages account for its supremacy in Balkan trade. Finally, Germany offers admirable statistical

TABLE XI—TRADE OF GERMANY AND BALKAN COUNTRIES, 1910
(In thousands of tons)

	TOTAL TRADE	By WATER- WAY	PER CENT	By RAILWAY	PER CENT	REMAIN- DER (By SEA)	PER CENT
IMPORTS INTO GERMANY FROM							
Rumania	550.8	27.6	5	27.9	5	495.3	90
Other Balkan States.....	306.5	68.0	22	32.7	11	205.8	67
Total.....	857.3	95.6	11	60.6	7	701.1	82
EXPORTS FROM GERMANY TO							
Rumania	168.6	3.6	2	86.9	52	78.1	47
Other Balkan States.....	263.5	20.5	8	53.5	21	189.5	72
Total.....	432.1	24.1	6	140.4	32	267.6	62
TOTAL EXPORTS AND IMPORTS	1,289.4	119.7	8	201.0	16	968.7	75

* I have compiled the figures for the total trade from *Statistik des Deutschen Reichs*, Vol. 252, *Auswärtiger Handel*, Parts IV and VII, Table A, *Spezialhandel nach Warengruppen*, taking the figures for 1910. Tonnage carried on internal waterways in 1910 is analyzed in the same series, Vol. 245, Part I, *Verkehr der deutschen Binnenwasserstrassen*. Extraordinarily complete figures of traffic by rail are provided in *Statistik der Güterbewegung auf deutschen Eisenbahnen nach Verkehrsbezirken geordnet*; as the last volume available to me was that for 1910, I have taken the other figures also for that year.

¹⁰ Transport by Donau-Dampfschiffahrts-Gesellschaft, 1912:

	Thousands of tons)	
	Imports from	Exports to
Serbia on Danube.....	14.5	37.2
Serbia on Save.....	0.5	0.5
Bosnia.....	22.8	9.7

The commercial statistics of Bosnia-Hercegovina do not distinguish the trade with Austria-Hungary from the trade with other countries but do give the proportions of the total external trade carried by different means of transportation. The following figures are simple averages of the percentage figures of the two years, 1910 and 1911.

Bosnia-Hercegovina, 1910-11, percentage of tonnage

	Imports	Exports	Total
Railroads.....	81	72	74
River trade.....	9	17	15
Roads and ferries.....	9	11	10
Direct trade with Serbia, Turkey, Montenegro.....	0.7	0.0	0.2

Cf. A. Korompay: *Der auswärtige Warenverkehr Bosniens und der Herzegowina im Jahre 1911 im Vergleich mit den Jahren 1910 und 1907*, *Statistische Monatschrift*, Vol. 40, 1914, pp. 232-241; reference on p. 240.

material for a study of its transportation system and is the only Continental state having important commercial relations with the Balkan countries that gives definite information on the means by which it trades with them. The significant figures are summarized in the preceding table (Table XI).

Comparing the Austrian and the German figures we find that the more distant country does a distinctly smaller business measured in gross tonnage; the value of the German trade is about the same, however, by reason of its superiority in industrial exports, in which value is condensed in a

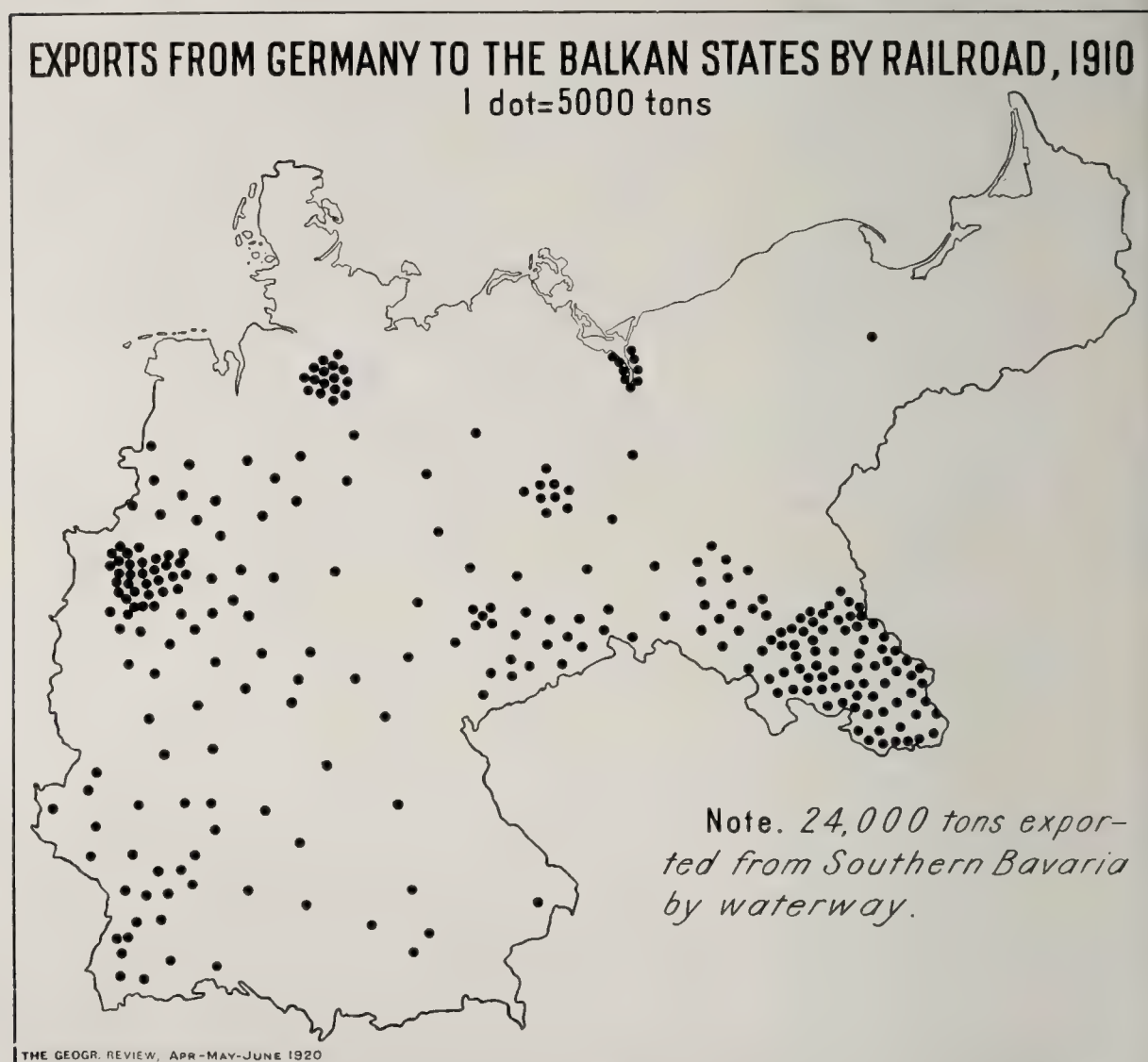


FIG. 3—Cartogram showing the amount and provenance of the exports by railroad from Germany to the Balkan states, 1910.

relatively small bulk. Analyzing the different modes of transport employed we find that internal waterways appears in the third place in both tables and were, naturally, of less importance in Germany than in Austria. The most striking feature is the reversal of the parts played respectively by the railway and by the sea. Of the Austrian trade 72 per cent went by rail and 17 per cent by sea; of the German trade 75 per cent went by sea and 16 per cent by rail. The figures here are based on tonnage, not on value, and would not be so curiously divergent if we had a better economic measure

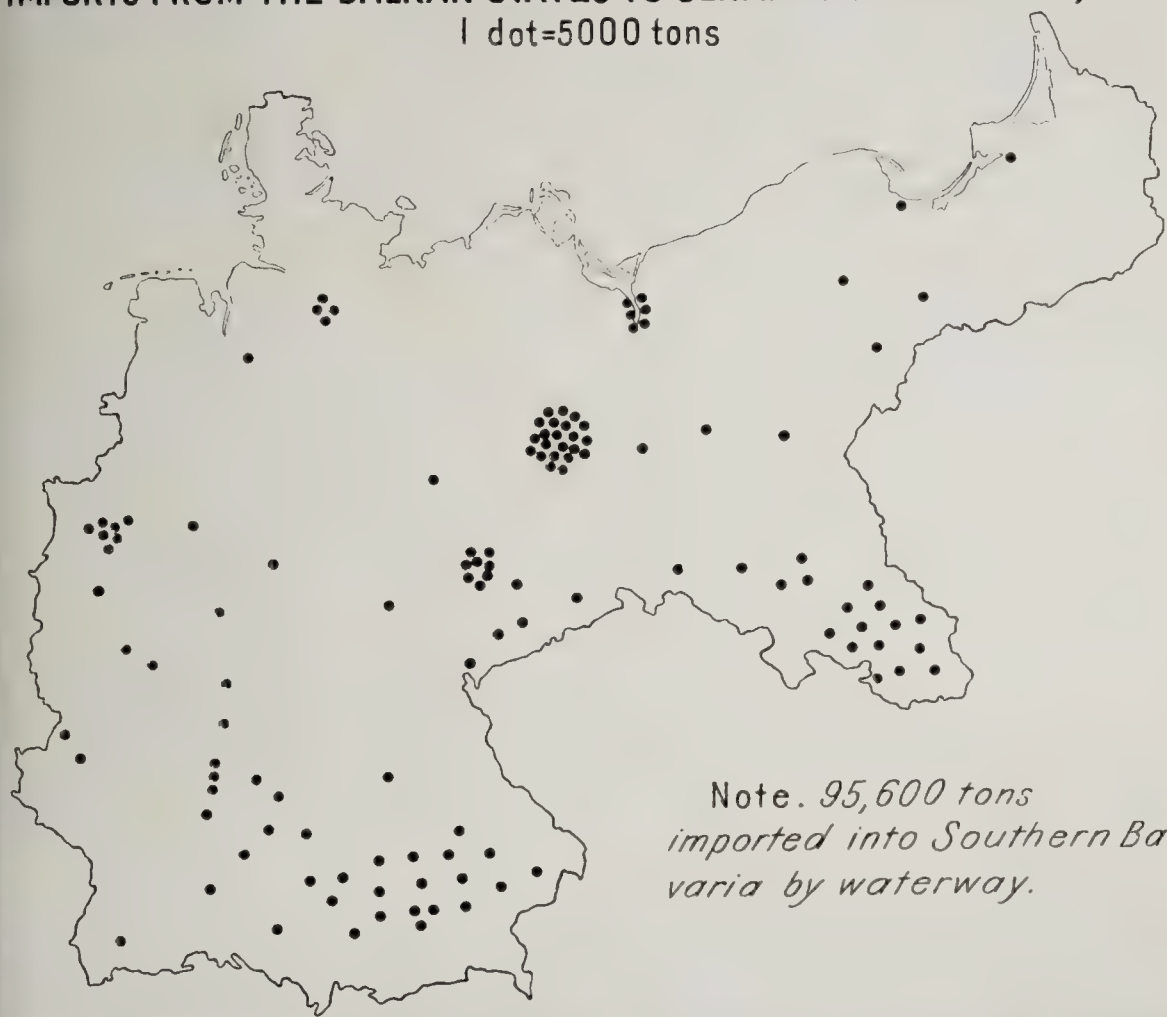
than that of mere weight. Taking the figures as they stand, however, some obvious conclusions result from them.

VALUE OF THE DANUBE RIVER AS A TRADE ROUTE

Germany has an advantage over competitors for Balkan trade in north-western Europe in her ability to make at least some use of the Danube route. It will be noted that Germany actually drew a larger tonnage up the Danube in 1910 than did Austria-Hungary in 1912. More extensive study of the statistics might show this comparison to be exceptional and mislead-

IMPORTS FROM THE BALKAN STATES TO GERMANY BY RAILROAD, 1910

1 dot=5000 tons



THE GEOGR. REVIEW, APR-MAY-JUNE 1920

FIG. 4—Cartogram showing the amount and destination of the imports by railroad from the Balkan states to Germany, 1910.

ing. Some reason for it appears, however, in the character of the wares brought by this route; they consisted largely of cereals, for which the demand is more active in southern Germany than in Austria. The exports from Germany by this route were a varied assortment; about half the tonnage was composed of iron and steel and metal wares. One item on the list is of interest because it presents so characteristic an example of the paradoxes of commerce: 800 tons of rice shipped from Bavaria to the Balkans! In general, the wares shipped downstream as well as upstream

seem to have been of the kind that usually would be carried by sea.

A study of the statistics of traffic on the internal waterways of Germany shows that the Danube outlet to the Balkan countries is of importance mainly to southern Bavaria. Not a ton of Balkan freight appears to have passed into or out of the basin of the upper Danube, coming from or going to other German waterways. Even the regions of the Ludwig Canal, the Main, and the Rhine show no water-borne freight movement connecting by the Danube with Balkan countries.

It is possible, of course, that some of the considerable tonnage of iron and steel which went down the Danube reached that river in small canal boats via the Rhine, Main, and Ludwig Canal and was there transferred to river boats. The traffic statistics do not enable us to answer this question. They consider only the immediate, not the ultimate, destination of wares.

COMPARATIVE VALUE OF RAIL AND WATER ROUTES IN GERMAN-BALKAN TRADE

Comparing now the waterway and the railway as an instrument to serve German commerce with the Balkans, we find that the railway does twice the work of the waterway, measured in tonnage of wares carried. The peculiar advantage of the railway is its relative independence of natural contours and its ability to follow a fairly straight path into any region that is not actually mountainous. While the Danube serves but a small part of Germany in its Balkan trade, the railway serves all Germany.

This fact stands out clearly when we study the districts in Germany in which most of the Balkan railroad freight arrives and departs (Figs. 3 and 4). The agricultural districts do little or no business with Balkan countries, being indeed their competitors. The industrial districts are the source of most of the outgoing freight to the Balkans, and the incoming freight goes in large part to the consuming population gathered in them and in the large cities.

When we seek to analyze the nature of the trade which Germany carries on with the Balkan countries by sea—three-quarters of the whole—we encounter practical difficulties. We may assume, of course, that all the trade with Greece went by the sea route, and it is safe to assume that most of the trade with Turkey in Europe followed the same course. All of the trade of Serbia was, of course, by land. To Bulgaria and Rumania wares could be shipped by sea or by railway or by internal waterway; we want to know which of these routes was followed by any particular ware and the reason why it chose this particular course. By combining and analyzing the statistics of traffic and of commerce an answer to the question may be obtained which will be approximately correct; but the process is a tedious one, and I shall attempt to present here merely impressions based on a partial study of the figures, not the conclusions of an exhaustive analysis.

In general I have the impression that any given ware might be shipped and was shipped by any one or by all three of the routes. The choice would apparently be determined not by the character of the article, except for such wares as fresh fruit, counting for little in the aggregate; it would be determined by the particular place in which the article originated, by the particular place of its destination, and by the particular time at which it was shipped. For example, the iron product from the region of Oppeln in Silesia went to Rumania by rail; it had a longer rail haul than if it had been taken to a seaport or to the Danube but escaped the costs of transshipment and water freight and could probably be laid down nearer the place where it was wanted than would be the case if it had been carried by a water route. Most of the iron that was exported to Serbia seems to have gone down the Danube and was probably distributed from Belgrade. This was probably manufactured in the Ruhr region; and from the same source doubtless went the bulk of the iron wares that were shipped to the peninsula by sea.

SEEMING ANOMALIES IN FREIGHT ROUTING

It is disconcerting, however, to find a shipment by rail to Rumania of 2,000 tons of steam boilers and tanks from the Pomeranian harbors, directly on the seaboard; and this example is but one of many that could be given of the defiance of theories by the facts. A reason doubtless lies behind every movement of freight, however insignificant it appears; but the reasons are often obscure because they are local and individual. They may result from the particular circumstances of the time, rather than of the place or of the ware. Part of the freight exchanged by railroad between Germany and the Balkan countries consisted undoubtedly of "rush" shipments. How large a part of the rail traffic was of this sort it is impossible to say. This part of the rail traffic, shipped in response to hurry-up orders, was probably of shifting character, composed at different times of different goods, according to the circumstances.

Furthermore, we must recognize that the influence of economic competition often diverts trade currents into lines which appear unnatural and socially disadvantageous. Much has been written on the service of trusts and similar would-be monopolies in organizing more efficiently the distribution of wares, abolishing the losses of cross-freights, etc.; but there is another side to the picture. Fierce competition, resulting in price cutting, "dumping," etc., will often make trade currents, in appearance, run up hill. A German *kartell*, dominating the market in some particular product, can exercise more influence than lofty mountain chains or level river valleys can exercise on the direction of traffic; and for a considerable period may exercise this influence, to the confusion of commercial geographers. Some German *kartells* have regularly framed their prices so as to counteract transportation charges, charging prices that were lower as regions

were farther away, and so practically annihilating the effects of distance.¹¹ Foreign territory has usually been left open to the unrestricted competition of the members of a trust and their rivals,¹² but it would certainly be unsafe to assume that in Germany's Balkan trade influences of this kind were wholly wanting.

REASONS FOR GERMANY'S DOMINANCE IN BALKAN TRADE

Looking away from the bewildering mass of detail and seeking some general conclusion, I think the following statements are clearly true. Germany has a particular advantage in Balkan trade both in the waterway of the Danube and in the railroad connections which bring her closer than her industrial competitors to the Balkan markets. On the other hand, with



FIG. 5—Cartogram showing the amount of export and import trade of Bulgaria by custom houses, 1911. (N. B.: The figures for exports and imports should be reversed.)

the choice of ways before her, Germany has carried on only one-fourth (in tonnage) of her Balkan commerce by the Continental route. For three-fourths of the trade she has chosen the open sea.

In two aspects this situation seems to me to be highly significant. In

¹¹ The Helmstädter-Braunkohlenbrikett-Syndikat furnishes an illustration:

Zone	Price
I	61
II	56
III	51
IV	48

Similar practices will be found in the German metal industries. Cf. Hugo Bonikowsky: *Der Einfluss der industriellen Kartelle auf den Handel in Deutschland*, Jena, 1907, p. 150.

¹² Josef Grunzel: *Ueber Kartelle*, Leipzig, 1902, p. 64.

the first place, it indicates that Germany's industrial neighbors, Belgium, France, and England, which appear to be hampered by the greater length of the overland route, are actually better situated than Germany to compete in three-fourths of the Balkan trade which Germany carries on. There is, I think, a fair measure of truth (though not all the truth), in the statement that Germany carries on overland trade with the Balkans because of the *disadvantages* of her position. Part of the German trade takes to the river route and the railroad because the producing and consuming districts

TABLE XII—GATEWAYS OF BULGARIAN TRADE, 1911 *
(Values in millions of francs)

	TOTAL	N	NW	W	SW	SE	E	NE
IMPORTS								
Orient R. R.....	66.2	40.8	18.5	0.9	2.3	2.6	0.2	0.7
River	46.1	25.9	7.4	1.4	1.4	0.6	7.4	2.0
Sea	85.3	21.3	34.0	6.8	6.5	11.2	1.2	4.3
Turkish	1.6	0.1	0.0	0.0	0.0	1.5	0.0	0.0
Total.....	199.3	88.1	60.0	9.1	10.5	16.0	8.7	7.0
EXPORTS								
Orient R. R.....	28.2	18.1	4.3	2.4	1.6	1.6	0.0	0.2
River	53.7	10.7	37.4	0.0	4.0	0.1	1.1	0.1
Sea	90.5	4.6	47.3	1.5	21.5	15.4	0.1	0.0
Turkish	12.1	0.1	0.0	0.0	0.0	12.1	0.0	0.0
Total.....	184.6	33.5	89.1	3.9	27.3	29.2	1.2	0.3
Combined Total.....	383.9	121.6	149.1	13.0	37.8	45.2	9.9	7.3

* Symbols heading the vertical columns have the following significance: N, Austria-Hungary, Germany; NW, England, France, Belgium; W, Italy; SW, Scattering, not otherwise specified; SE, Turkey; E, Rumania; NE Russia.

Custom houses are grouped as follows in the horizontal lines of figures: Orient Railroad includes Tsaribrod, Sofia, Plovdiv (*not* Harmanly); River includes Vidin, Lom, Oryekhovo, Somovit, Nikopol, Svishchov, Rushchuk, Tutrakan, Silistra; Sea includes Kavarna, Balchik, Varna, Burgas; Turkish includes Kyustendil, Kocharinovo, Chepelare, Harmanly, Vakaf, Kozlets (Mandra) Kaibilyar.

The table is compiled by grouping figures supplied in *Statistique du Commerce du Royaume de Bulgarie 1911*, Sofia, 1914, Table 14. Figures in the table are merely approximations in gross; considerable discrepancies will appear when the vertical column of totals is checked by the sum of items in the horizontal lines.

in Germany are so far from deep-water harbors that they cannot afford to take the sea route. Manchester and Middlesbrough, Roubaix and Lille are better situated for Balkan trade than Essen and Oppeln, Solingen and Chemnitz.

In the second place, looking at the matter from the standpoint of Balkan countries, these considerations indicate that the first requisite for their commercial prosperity is not a Continental connection by railroad or river but good harbors on the open sea with ready access to the interior. Balkan trade currents flow northwest and north, but they reach their destination by starting in the opposite direction, southeast and south, and make a great curve to reach their final objective.

BULGARIA AS AN EXAMPLE FOR THE ANALYSIS OF TRADE CURRENTS

The matter will be more evident if we study in detail the trade currents of a particular Balkan country. Let us take Bulgaria, which is well adapted to our purpose since it has direct railroad and river connections with the

Continent and an outlet through the Black Sea and the Straits. Bulgarian trade statistics fortunately provide the means of analyzing in detail the trade currents flowing in and out through different gateways, and the accompanying table and map (Table XII and Fig. 5) present a compilation from them designed to illustrate this point.

The table shows that Bulgaria depends upon the Orient Railroad for about one-third of its import trade; most of the wares arriving by this route come from Austria-Hungary and Germany, are entered at Sofia, and are consumed in the capital or are distributed from there. Harmanly is a station on this road, but its trade is almost entirely with Turkey, and I have therefore grouped it with the other custom houses on the Turkish frontier. For export purposes the railroad is relatively unimportant.

A slightly larger proportion of the aggregate trade enters and leaves the country by the river ports. Two points are to be noted, however, in judging the significance of the figures under this head in the table. More than half of the import trade of the river ports passed through Rushchuk, which is a connecting point with the Rumanian railroads and which probably received more goods by rail than by water. Furthermore, an analysis of the exports leaving by the river gateways shows that a relatively small part could have gone upstream and that the largest part, destined for Belgium and England, must have gone downstream and been shipped by sea. Even Vidin, for example, which lies only a short distance below the Iron Gate, exported (in thousands of francs) only 275 to Austria-Hungary and only 16 to Germany, while it exported 1,100 to England and 5,298 to Belgium. The Danube serves Bulgaria, evidently, as an outlet to the sea rather than as a means of access to Central Europe.¹³

Even if no allowance be made for the maritime traffic concealed in the figures of trade by the river ports, the statistics of exports and imports by sea take the place of preponderant importance. It should be noted that these figures were compiled at a time when Bulgaria had no access to the Aegean except through Turkish territory. Leaving aside the question of the importance to Bulgaria of the Dedeagach outlet, it is apparent that even the route through the Black Sea, which is apparently so roundabout, was distinctly superior in economic value to the direct connections by rail and river.

A study of the figures of the commerce of Rumania leads to the same conclusion as regards that state.

¹³ This conclusion is borne out by the statistics of tonnage and nationality of shipping on the Danube published in the *Annuaire Statistique du Royaume de Bulgarie*.

THE NEW BOUNDARIES OF BULGARIA

The status of the peace treaties terminating the war was discussed in a note in the December, 1919, *Geographical Review* (pp. 357-358). It was there stated that the third treaty signed was the treaty with Bulgaria, signed at Neuilly on November 27, 1919. The full official text was not then available. It has since become available,¹ and the territorial provisions (Article 27) are herewith reprinted from it. The segments of the boundary which differ from the pre-war boundary were identified and plotted on the proper sheets of the standard Austrian staff map entitled "Generalkarte von Mitteleuropa, 1:200,000" and were then reduced and transferred to the accompanying map (Fig. 1). The names of all the geographical features mentioned in the treaty text are shown on the main map or on the insets.

In the following reprint each two paragraphs describing a segment of the boundary in the original have, for the sake of clearness, as in our reprint of the Austrian treaty (December, 1919, *Review*), been combined into one paragraph throughout. Also, in footnotes is given the spelling of the Austrian staff map of all names which differ from it in the treaty text. On the Austrian map the Croatian alphabet is used to transliterate Bulgarian names. In the treaty text the accent ˇ of this alphabet is omitted. Thus a *c* may stand for its (Croatian) sound of *ts* or, with accent omitted, of *ch*, an *s* for an *s* or *sh* sound. To add to the confusion, some names, as Topolovitsa (Croatian: Topolovica), Dragovishtitsa (Croatian: Drago-vištica), are transliterated according to English phonetics, and one name, that of the Maritsa River, occurs in both forms in the text. Inasmuch as the Austrian map has obviously been used as a basis for the definition of the boundary, it has been thought best to accept its spelling as standard.

ARTICLE 27

The frontiers of Bulgaria shall be fixed as follows (see annexed map):

1. *With the Serb-Croat-Slovene State:*

From the confluence of the Timok and the Danube, which is the point common to the three frontiers of Bulgaria, Rumania, and the Serb-Croat-Slovene State, southwards to a point to be selected on the course of the Timok near point 38 west of Bregovo, the course of the Timok upstream;

thence southwestwards to the point east of Vlk. Izvor where the old frontier between Serbia and Bulgaria meets the river Bezdanica, a line to be fixed on the ground passing through points 274 and 367, following generally the watershed between the

¹ *Traité de paix entre les puissances alliées et associées et la Bulgarie signé à Neuilly le 29 novembre 1919.* iv+iii+iv+393 pp. [Paris, 1919]. 12½x8½ inches. Text in French, English, and Italian. Accompanied, in pocket, by map, 1:1,000,000, showing the new boundaries on a transfer of a section of the Royal Geographical Society's map of Europe on that scale.

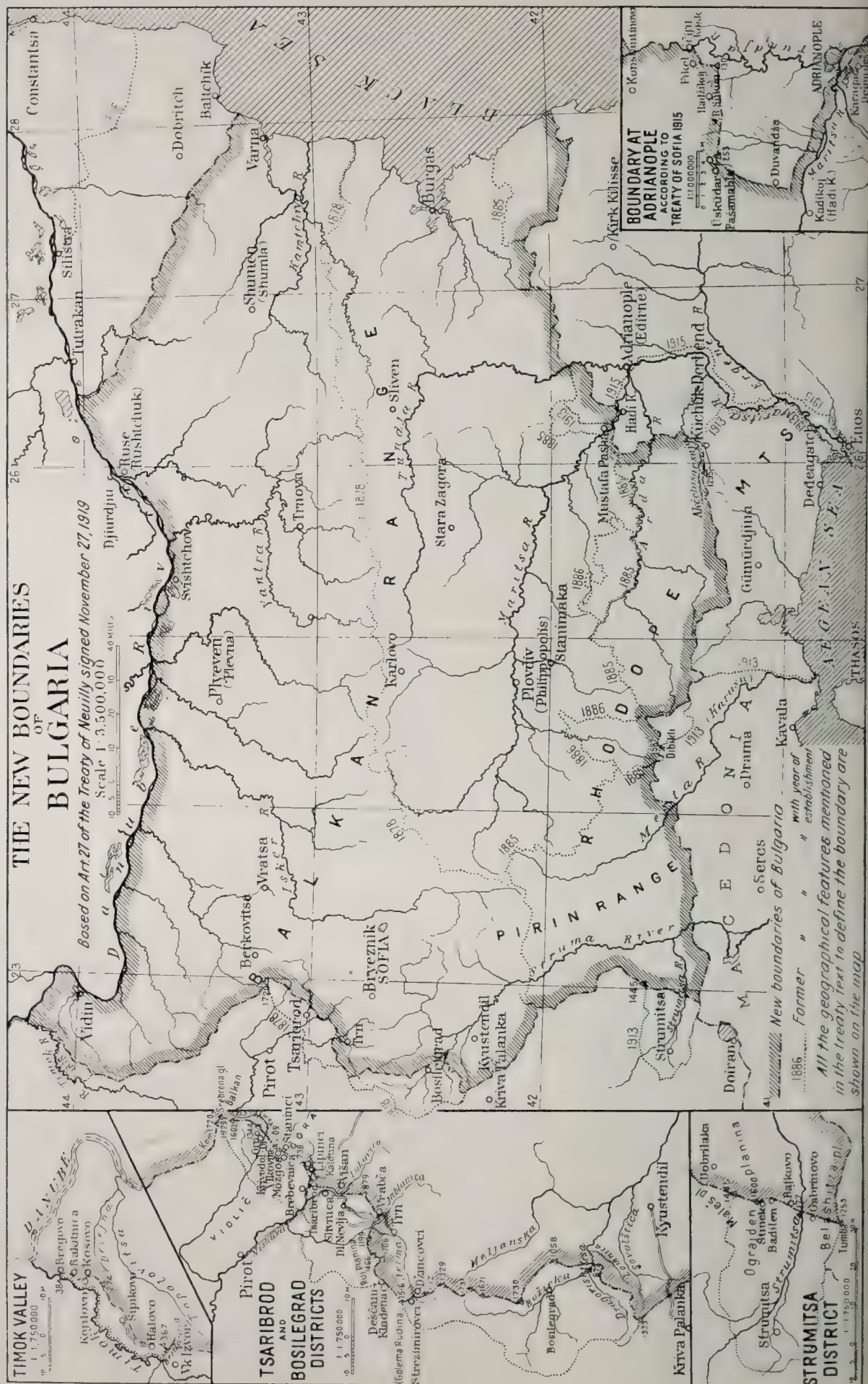
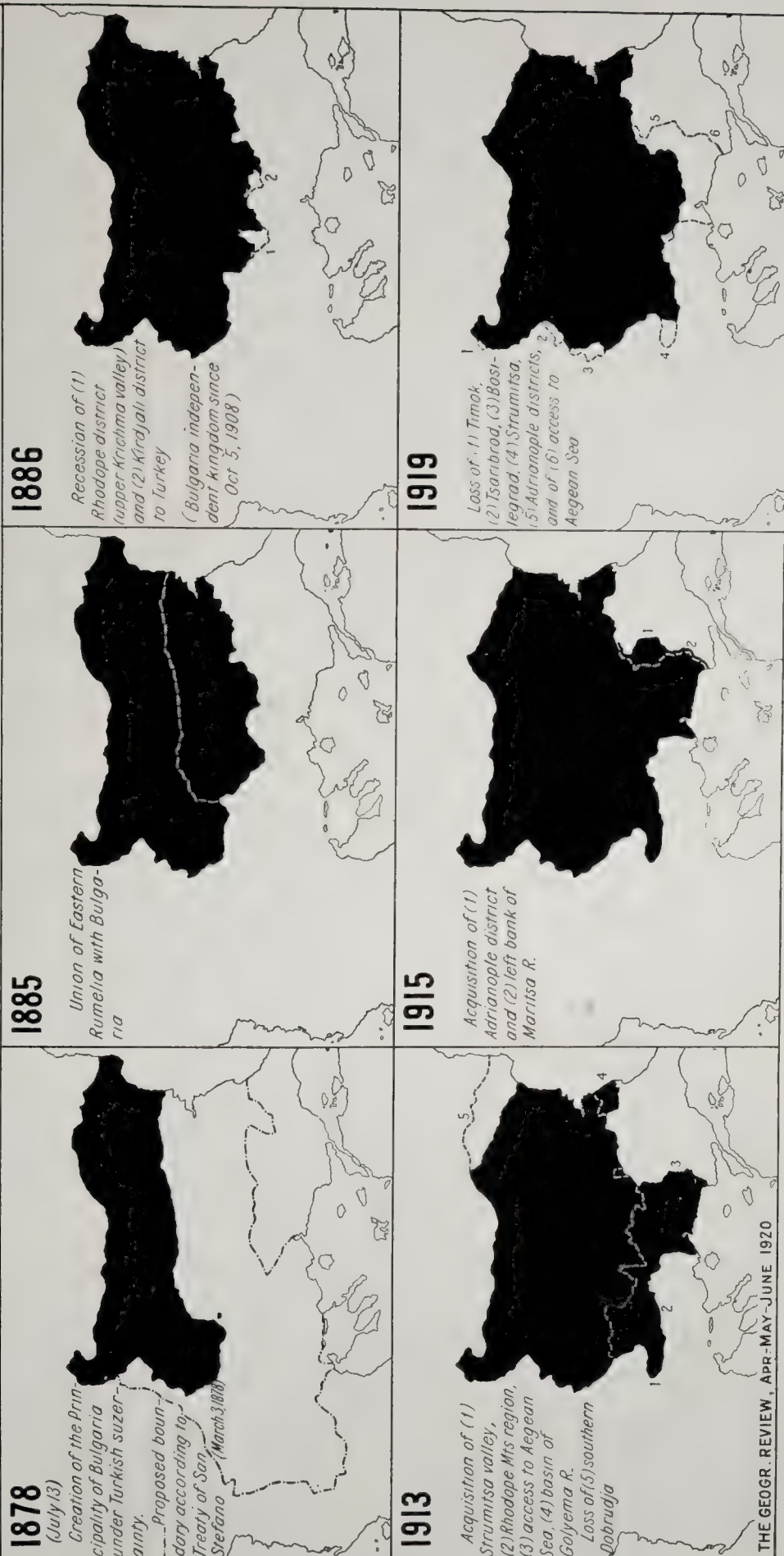


FIG. 1

THE TERRITORIAL DEVELOPMENT OF BULGARIA, 1878-1919

1 : 15,000,000



THE GEOGR. REVIEW, APR.-MAY-JUNE 1920

FIG. 2.

basins of the Timok on the northwest and the Topolovitsa² and Delejna on the south east, leaving to the Serb-Croat-Slovene State Kojilovo, Sipikovo, and Halovo, with the road connecting the two latter places, and to Bulgaria Bregovo, Rakitnica, and Kosovo;

thence southwards to point 1720, about 12 kilometers west-southwest of Berkovitsa,³ the old frontier between Bulgaria and Serbia;

thence southeastwards for about 1½ kilometers to point 1929 (Srebrena gl.), a line to be fixed on the crest of the Kom Balkan;

thence south-southwestwards to point 1109, on the Vidlic⁴ Gora south of Vlkovija, a line to be fixed on the ground passing through points 1602 and 1344, passing east of Grn. Krivodol and crossing the river Komstica⁵ about 1½ kilometers above Dl. Krivodol;

thence to a point on the Tsaribrod⁶-Sofiya road immediately west of its junction with the road to Kalotina, a line to be fixed on the ground passing east of Mözgos,⁷ west of Staninci, east of Brebevnica, and through point 738 northeast of Lipinci;

thence west-southwestwards to a point to be selected on the course of the river Lukavica about 1,100 meters northeast of Slivnica, a line to be fixed on the ground;

thence southwards to the confluence, west of Visan,⁸ of the Lukavica with the stream on which Dl. Nevlja is situated, the course of the Lukavica upstream;

thence southwestwards to the confluence of a stream with the Jablanica, west of Vrabca,⁹ a line to be fixed on the ground passing through point 879 and cutting the road from Trn to Tsaribrod immediately south of the junction of this road with the direct road from Trn to Pirot;

thence northwards to the confluence of the Jablanica and the Jerma (Trnska) the course of the Jablanica;

thence westwards to a point to be selected on the old frontier at the salient near Descani¹⁰ Kladenac, a line to be fixed on the ground following the crest of the Ruj Planina and passing through points 1199, 1466, and 1706;

thence southwestwards to point 1516 (Golema Rudina) about 17 kilometers west of Trn, the old Serb-Bulgarian frontier;

thence southwards to a point to be selected on the river Jerma (Trnska) east of Strezimirovci, a line to be fixed on the ground;

thence southwards to the river Dragovishtitsa¹¹ immediately below the confluence of rivers near point 672, a line to be fixed on the ground passing west of Dzinčovci,¹² through points 1112 and 1329, following the watershed between the basins of the rivers Bozicka¹³ and Meljanska and passing through points 1731, 1671, 1730, and 1058;

thence southwestwards to the old Serb-Bulgarian frontier at point 1333, about 10 kilometers northwest of the point where the road from Kriva-Palanka to Kyustendil cuts this frontier, a line to be fixed on the ground following the watershed between the Dragovishtitsa on the northwest and the Lomnica and Sovolstica¹⁴ on the southeast;

thence southeastwards to point 1445 on the Males¹⁵ Planina southwest of Dobrilaka, the old Serb-Bulgarian frontier;

thence south-southwestwards to Tumba (point 1253) on the Belashitza¹⁶ Planina, the point of junction of the three frontiers of Greece, Bulgaria, and the Serb-Croat-

² Topolovica in Croat transliteration; thus on the 1:200,000 map.

³ Croat: Berkovica.

⁴ Vidlic.

⁵ Komstica.

⁶ Croat: Caribrod.

⁷ Mözgos.

⁸ Visan.

⁹ Vrabca.

¹⁰ Descani.

¹¹ Croat: Dragovistica.

¹² Dzinčovci.

¹³ Bozicka.

¹⁴ Sovolstica.

¹⁵ Males.

¹⁶ Croat: Belasitca.

Slovene State, a line to be fixed on the ground passing through point 1600 on the Ograjden¹⁷ Planina, passing east of Stinek and Badilen, west of Bajkovo, cutting the Strumitsa¹⁸ about 3 kilometers east of point 177, and passing east of Gabrinovo.

2. *With Greece:*

From the point defined above eastwards to the point where it leaves the watershed between the basins of the Mesta-Karasu on the south and the Marica¹⁹ on the north near point 1587 (Dibikli), the frontier of 1913 between Bulgaria and Greece.

3. *On the South, with territories which shall be subsequently attributed by the Principal Allied and Associated Powers:*

thence eastwards to the point 1295 situated about 18 kilometers west of Kuchuk²⁰-Derbend, a line to be fixed on the ground following the watershed between the basin of the Maritsa on the north, and the basins of the Mesta-Karasu and the other rivers which flow directly into the Egean Sea on the south;

thence eastwards to a point to be chosen on the frontier of 1913 between Bulgaria and Turkey about 4 kilometers north of Kuchuk-Derbend, a line to be fixed on the ground following as nearly as possible the crest line forming the southern limit of the basin of the Archehisar (Dzuma) Suju;²¹

thence northwards to the point where it meets the river Maritsa, the frontier of 1913;

thence to a point to be chosen about 3 kilometers below the railway station of Hadi-K (Kadikoj)²² the principal course of the Maritsa downstream;

thence northwards to a point to be chosen on the apex of the salient formed by the frontier of the Treaty of Sofia, 1915, about 10 kilometers east-southeast of Jisir Mustafa Pasha, a line to be fixed on the ground;

thence eastwards to the Black Sea, the frontier of the Treaty of Sofia, 1915, then the frontier of 1913.

4. *The Black Sea.*

5. *With Rumania:*

From the Black Sea to the Danube, the frontier existing on August 1, 1914;

thence to the confluence of the Timok and the Danube, the principal channel of navigation of the Danube upstream.

ARTICLE 28

The frontiers described by the present treaty are traced, for such parts as are defined, on the one in a million map attached to the present treaty. In case of differences between the text and the map, the text will prevail.

The next-to-last paragraph of Section 3 refers to the Treaty of Sofia of 1915. It was by this treaty that Bulgaria gained control of the whole line of railroad along the Maritsa River and advanced her boundary to the outskirts of Adrianople. It was partly as a result of this treaty that Bulgaria entered the war on the side of the Central Empires. Having been signed more than a year after the war began (O. S. August 24, N. S. September 6, 1915), its text was not easily available among the Allied countries. It has recently, however, been published in the British "State Papers," Vol. 109. As its geographical clauses are a necessary element in

¹⁷ Ograzden.

¹⁸ Croat: Strumica.

¹⁹ Sic: "Maritsa" below.

²⁰ Kûc[ûk].

²¹ Akcehisar (Dzuma) suju.

²² Kadiköj.

the definition of the new boundaries of Bulgaria, they are given herewith translated as reprinted from the original French in the *Geographical Journal* for February, 1920 (pp. 137-138). The names have, in this case likewise been changed to conform with the Austrian map. It is an interesting feature of this treaty that, in two places, the location of the boundary is defined, not in terms of the terrain itself but by the fortuitous position of the lettering on a map!

TREATY OF SOFIA, 1915

ARTICLE 1

The Ottoman Empire agrees to rectify the present frontier in the following manner:

From Konstantinovo (Tatarköy) the Bulgarian-Turkish frontier is to follow the right bank (*talweg*) of the Tundja [Tundža] River as far as the village [should read manor house] of Čiftlik Köşk; from this point it follows the crest between Fikel and the Tundja to the summit of elevation 130; thence it turns west as a straight line, passing below Hadžiköj and R[uin] Sükün, and reaches the summit of elevation 253; leaving Pašamahle and Üsküdar to Bulgaria, it follows the *talweg* between the crest of Duvandža and that of Üsküdar, leaving Duvandža to Turkey, as far as a point situated 2 kilometers distant from the left bank of the Maritsa. From this point to the letter č in the word Karagač the frontier is to be laid out by the Delimitation Commission, according to the principles mentioned in Article 2, from 1½ to 2 kilometers at the most north of the left bank of the Maritsa. From the letter č of the word Karagač, a town assigned to Bulgaria, the frontier cuts the highroad Karagač-Adrianople in the middle and continues in a straight line to the letter š of the word Demirdeš; thence it crosses the Maritsa again and reaches the left bank of the river. From this point the frontier is to follow the left bank of the river at a maximum distance of 2 kilometers east of the left bank until it reaches the sea. It will be laid down by the Delimitation Commission according to the principles mentioned in Article 2.

The map of the Austrian General Staff in 1:200,000 is to serve as the underlying map.

ARTICLE 2 (in part)

The Delimitation Commission will be guided in its work by the topographic and economic conditions of the terrain and will lay down the frontier from the letters š in the word Demirdeš to the mouth of the Maritsa at a maximum distance of 2 kilometers east of the left bank of the river, leaving the city of Enos to Turkey.

AREA AND POPULATION

While Bulgaria thus loses considerable territory as a result of the world war, yet her new area does not compare unfavorably with the area she has occupied continuously for a longer period than any other, i. e. her extent from 1886 to 1913, an interval of 27 years of her 42 years of existence. This is evident from a glance at the accompanying series of "silhouette" maps (Fig. 2), which illustrates the territorial development

of Bulgaria by critical dates. The legend of each map indicates the territory gained or lost since the date represented by the preceding map. The boundaries of these pieces of territory can be followed in greater detail on Figure 1, where they are shown by dotted lines, with the year of their establishment.

In the following table the attempt has been made to give the area and population of Bulgaria at each stage of its development, based on a critical selection of figures from the standard references cited as footnotes thereto.

AREA AND POPULATION OF BULGARIA AT PERIODS
OF TERRITORIAL CHANGE

	1878	1885	1886	1913	1915	1919
Area in sq. kilometers	63,160*	99,061‡	96,346||	114,017**	116,642‡‡	105,522|||
Approximate Population	1,990,000†	3,100,000§	3,030,000¶	4,712,000††	4,900,000§§	4,300,000¶¶

Abbreviation: BdE=Bevölkerung der Erde, a critical compilation of the population of the countries of the world, each constituting a number of the *Ergänzungshefte zu Petermanns Mitteilungen*, as follows: VI, 1880, No. 62; VII, 1882, No. 69; VIII, 1891, No. 101; XIII, 1909, No. 163.

* Figure based on a planimetric measurement in 1890 by B. Trognitz of the Almanach de Gotha and accepted as standard in its subsequent issues. See BdE VIII, pp. 32 and 44.

† Based on: Population of Bulgaria proper (1873) according to V. Jaksic, 1,965,474; according to census of 1881, 2,007,919. See BdE VI, p. 22, and BdE VIII, p. 44.

‡ Compounded of two possibly not strictly co-ordinate figures: 63,160 for Bulgaria proper (see asterisk footnote above), and 35,901 for Eastern Rumelia, including the Kirdjali and Rhodope districts, based on an earlier planimetric measurement by Trognitz (in which the corresponding value for Bulgaria proper was 63,972). See BdE VII, p. 17, and BdE VIII, pp. 32 and 44.

§ Based on: Population of Bulgaria proper (census of 1881) 2,007,919; of Eastern Rumelia (census of 1880) 815,946; total (1880-81) 2,823,865. Population of Bulgaria proper (census of 1888) 2,193,434; of Eastern Rumelia, 960,941; total (1888) 3,154,375. For figures see BdE VIII, p. 44.

|| Official figures of Bulgarian census of 1900, quoted in BdE XIII, p. 123.

¶ Based on population of Bulgaria proper as estimated above for 1885, less population of Rhodope (19,326) and Kirdjali (28,721) districts—total 48,047—with allowance for natural increase during one year. See BdE VIII, p. 44, footnote 3 on Bulgaria.

** Almanach de Gotha, 1916, p. 708. The figures on which this is based, viz. 1910 area of Bulgaria (96,345), plus territory acquired from Turkey (25,257), minus loss to Rumania (7525) would give 114,077, however.

†† 4,711,918, Almanach de Gotha, 1916, p. 708, made up of 1910 census population of Bulgaria (4,337,513), plus population of territory acquired from Turkey (656,535), minus population of territory ceded to Rumania (282,131). Natural increase assumed offset by the Balkan wars.

‡‡ Based on measurement at the American Geographical Society from plot on millimeter cross-section paper, in 1:1,000,000, of area acquired in 1915 (result: 2625).

§§ Estimated population of 1913, plus 150,000 for area acquired in 1915, plus 50,000 for natural increase 1913-15.

||| 1913 area (114,017), minus areas by which it is reduced (Timok district, 170; Tsaribrod district, 566; Bosilegrad district, 828; Strumitsa district, 926; "Dibikli exclave," 242; Aegean access, 6136), plus area retained from 1915 (373), as shown on the map accompanying the peace treaty (the boundaries of the area, acquired in 1915 are not shown on this map). The seven areas involved were likewise plotted in 1:1,000,000 on millimeter cross-section paper, with the result given in the above figures.

¶¶ Estimated population of 1915, less assumed losses in Aegean corridor (200,000), area acquired in 1915 (150,000), Timok, Tsaribrod, Bosilegrad, Strumitsa districts (200,000), plus assumed excess of natural increase over war losses, 1915-19 (50,000).

THE OPEN PORTS OF CHINA

By E. T. WILLIAMS
University of California

The residence of foreigners in China, excepting that of missionaries, who may live where they please, is restricted to certain cities and towns known as "open ports." Formerly none but seaports were open to such residence; but at present a large number of inland cities are included which only by courtesy can be called "ports," much as one of our own interior cities, Columbus, Ohio, for instance, is for customs purposes a port of entry into the United States.

History of the Opening of Chinese Cities to Foreign Trade and Residence

China's earliest commerce appears to have been an overland trade with the countries of central and western Asia.¹ It does not appear to have been hampered by any restrictions as to the coming and going of foreign travelers or merchants. They seem to have been allowed to reside where they pleased, but their numbers were very few.

EARLY METHOD OF CONTROL OF ALIENS

This overland trade was supplemented before the third century of the Christian era by a considerable amount of sea-borne commerce which was conducted through the ports of what is now known as Indo-China; but by 300 A. D. Canton had become the port chiefly interested in this trade and already had a colony of Indians, Persians, and Arabs.² For some centuries thereafter foreign vessels appear to have been restricted by custom if not by law to the use of this one port, and the foreigners who came there to live were segregated by the local authorities and placed under the supervision of a headman chosen from among their own number. This practice has led some writers to think that China recognized the right of foreigners to extraterritoriality, but this is a mistake; China never consented to the exercise of extraterritorial jurisdiction by foreign states until forced to do so by defeat in war, when the treaty of 1842 with Great Britain was signed.

The headman appointed to preserve order among the foreign residents

¹ E. H. Parker: *China: Her History, Diplomacy, and Commerce from the Earliest Times to the Present Day*, New York, 1901, pp. 46-50.

² Chau Ju-kua: *His Work on the Chinese and Arab Trade in the Twelfth and Thirteenth Centuries* entitled *Chu-fan-chi*. Transl. from the Chinese and annotated by F. Hirth and W. W. Rockhill, St. Petersburg, 1911, p. 4 *et seqq.*

of Canton was not a representative of any foreign government nor chosen by any foreign official; he represented the Chinese officials and assisted them in enforcing upon the foreign residents the observance of Chinese laws and ordinances. It is interesting to note, however, that he was permitted in the case of minor offences to substitute, according to a fixed scale of equivalents, so many strokes of the rattan for those of the bamboo prescribed by the Chinese code, because the foreigner was accustomed to the use of the rattan.³

This custom of controlling aliens through their own representatives was employed by the Spaniards for the government of the Chinese in the Philippines⁴ and by the Dutch for the administration of the law among the Chinese in Java.⁵ It appears also to have been the method employed by the ancient Romans for the control of certain foreign colonies in the empire, such as those of the Jews in Alexandria and elsewhere.⁶

ARAB MONOPOLY OF CHINESE TRADE IN THE MIDDLE AGES

By the eighth century of the Christian era the foreign trade of Canton seems to have been almost entirely monopolized by the Arabs, and for eight hundred years they retained this control. They were good Mohammedans and assembled themselves on Fridays for worship in the mosque which they had established in the foreign quarter of Canton.⁷ A tomb, alleged to be that of a maternal uncle of the Prophet, is still shown to visitors there.⁸ This long and unbroken intercourse between Arabia and China left its effect upon both peoples. The familiar story of Aladdin and his wonderful lamp in the "Arabian Nights" was that of a Chinese boy.

As early as the ninth century of our era this trade of the Arabs spread to Chüanchow, near the modern port of Amoy, and at about the same time to Mingchow (now Ningpo) and Hangechow.⁹ On the Chinese side this foreign commerce was a government monopoly and had become so valuable by the tenth century that an official mission was sent abroad to investigate and report methods for its encouragement.¹⁰ In the twelfth century there appears to have been a reaction, for we find the trade restricted to Canton and Chüanchow.¹¹ By the thirteenth century the Mongols were in possession of China and had established peace through the greater part of Asia. They encouraged foreign intercourse and trade and appointed commission-

³ Chau Ju-Kua, pp. 16-17.

⁴ F. H. Sawyer: *The Inhabitants of the Philippines*, New York, 1900, p. 291.

⁵ T. S. Raffles: *The History of Java*, 2 vols., London, 1817; reference in Vol. 1, p. 75.

⁶ Emil Schürer: *History of the Jewish People in the Time of Jesus Christ*, Engl. transl., 5 vols., Edinburgh, 1886-90; reference in Division II, Vol. 2, pp. 244 and 263.

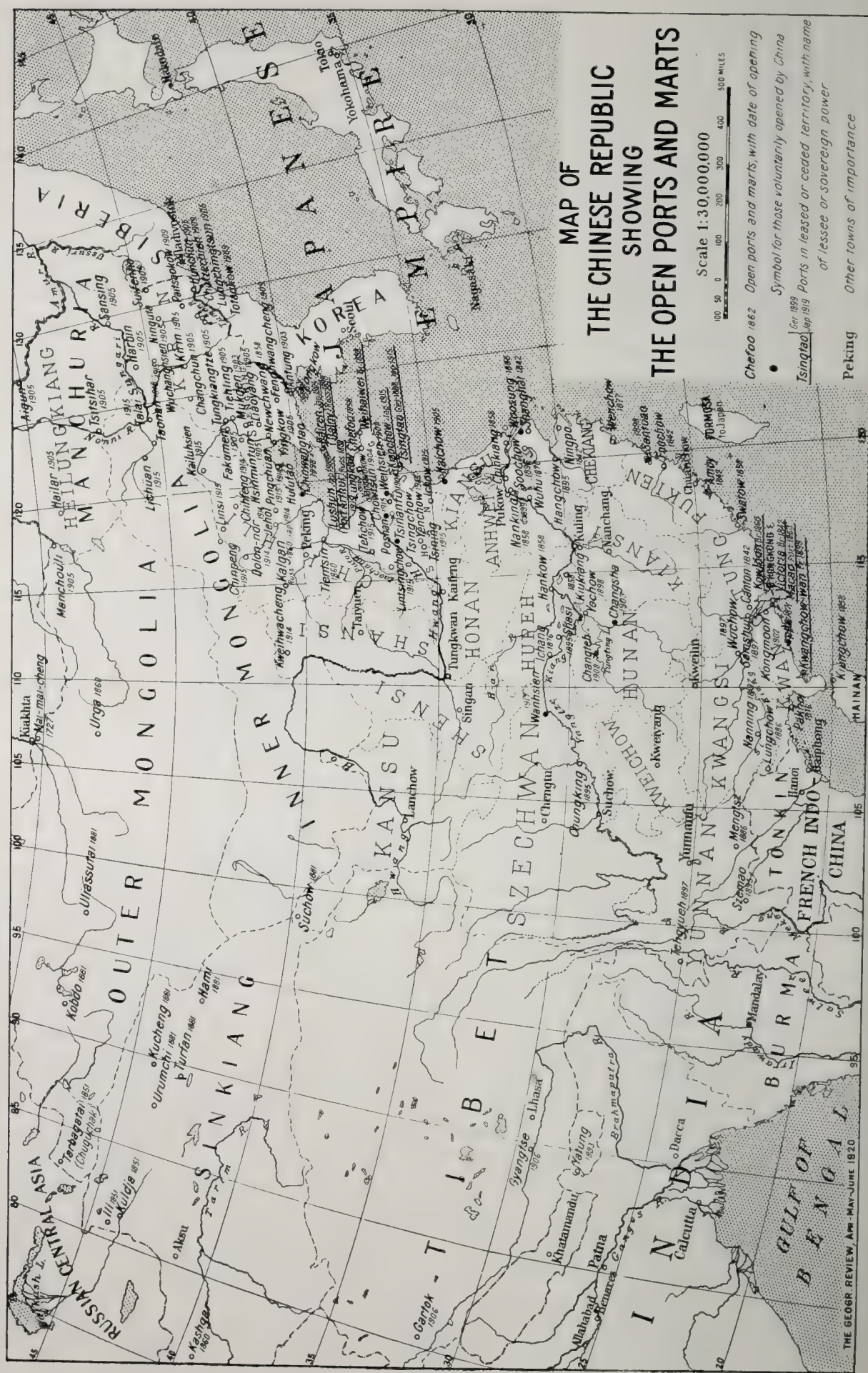
⁷ Chau Ju-kua, pp. 15 and 16.

⁸ S. W. Williams: *The Middle Kingdom*, revised edit., 2 vols., New York, 1883; reference in Vol. 2, p. 269.

⁹ Chau Ju-kua, pp. 17 and 20.

¹⁰ *Ibid.*, p. 19.

¹¹ *Ibid.*, p. 22.



ers of maritime shipping at Shanghai, Hangechow, Ningpo, Wenchow, Chüanchow, and Canton.¹²

As early as the fifth century of our era the bay of Kiaochow, whose possession is now the subject of dispute between China and Japan, was mentioned by the monk Fa-hien as the place near which he landed on his return from India,¹³ but his vessel had been driven out of its course by a typhoon and quite unintentionally reached the coast of Shantung. There is some reason to believe that this bay may have been used by foreign vessels in very early times; but the evidence is not conclusive, and, generally speaking, the inhabitants of the coast provinces north of the Yangtze River took but little interest in foreign trade until after the second war with Great Britain (1860).

PORTUGUESE TRADE AND THE OPENING OF MACAO

When the Portuguese rounded the Cape of Good Hope in 1498 and made their way to India the Arab-Venetian trade over the Isthmus of Suez began to decline. In vain the Arabs endeavored to keep the Portuguese out of Canton; the monopoly of China's foreign trade was lost by them and passed for a time to Portugal. Following the example of the Arabs, the Portuguese extended their trade to Ningpo, Chüanchow, and Foochow, but the conduct of the foreign merchants was so scandalous that in 1545 the Emperor of China ordered them to be attacked wherever found. A massacre occurred in Ningpo which resulted in the death of 12,000 people, of whom 800 were Portuguese, and in the burning of 35 ships and two junks. A similar massacre took place in Chüanchow in 1549.¹⁴ This forced the Portuguese to seek refuge on the island of Lampaco, where they had had a settlement for some years. All other ports were closed against them until 1557, when they persuaded the Chinese authorities to permit them to erect sheds for storing cargo at Macao, where in previous years foreigners had at times been allowed temporary shelter. Gradually thereafter Macao became the place of residence for all foreign merchants in China. In 1757 an Imperial Edict restricted all foreign trade to Canton,¹⁵ but after the season closed the merchants were compelled to leave Canton and return to Macao, where, as their numbers grew, they were in after years required to leave their families the year round. The Portuguese leased Macao and in recognition of Chinese sovereignty paid an annual rent until 1849. After that date they refused to pay any rent and claimed the sovereignty of the

¹² Sir Henry Yule, transl. and edit.: *The Book of Ser Marco Polo the Venetian Concerning the Kingdoms and Marvels of the East*, 3rd edit., revised by H. Cordier, 2 vols., London, 1903; reference in Vol. 2, p. 238.

¹³ See "A Record of Buddhistic Kingdoms: Being an Account by the Chinese Monk Fa-hien of His Travels in India and Ceylon (A. D. 399-414) in Search of the Buddhist Books of Discipline," transl. by J. Legge, Oxford, 1886, p. 114.

¹⁴ H. B. Morse: *The International Relations of the Chinese Empire*, 3 vols., London, 1910-18; reference in Vol. 1, p. 42.

¹⁵ *Ibid.*, Vol. 1, p. 67.

place—a claim which the Chinese would not admit until 1887.¹⁶ Macao lies at the end of a very small peninsula at the west side of the entrance to the Canton estuary. It is still a Portuguese possession, but for several decades has had a very unsavory reputation and has altogether ceased to have any commercial importance.

THE BRITISH EAST INDIA COMPANY AT CANTON

During the eighteenth century the foreign trade of China was very largely in the hands of the British East India Company, which had a monopoly of the British share in it. Various attempts were made by the company to extend its trade to other ports than Canton, but without success. The Co-Hong at Canton, which monopolized the trade from the Chinese side, opposed such attempts with all its influence, and that was too great to be overcome. The British East India Company was dissolved in 1834, but the Chinese Co-Hong continued to enjoy its special privileges, for which the Chinese Government exacted a good share of the profits. To meet these demands the Co-Hong had to squeeze the foreign merchants. Through the Co-Hong, too, the Chinese officials imposed upon the foreigners many irksome regulations. Complaints of excessive charges and annoying restrictions were among the chief causes of the first war (1840-1842) between Great Britain and China. That war resulted in the Treaty of Nanking, by which the Co-Hong was abolished, all monopolies were forbidden, and five ports instead of one opened to the residence and trade of foreigners.

THE CESSION OF HONGKONG TO GREAT BRITAIN

These five ports were Canton, Amoy, Foochow, Ningpo, and Shanghai, the same ports which for more than seven hundred years had at various times participated in the trade—the port of Amoy being for all practical purposes identical with Chüanchow, a few miles distant. By the same treaty the island of Hongkong, lying just outside the mouth of the Canton estuary, was ceded to Great Britain.

The establishment of a free port at Victoria on the island of Hongkong under the protection of Great Britain, where merchants were no longer annoyed by the heavy exactions and petty restrictions of the Canton officials, soon deprived the latter city of its prestige. The great business houses made their headquarters at Hongkong, and in the safe and spacious harbor of Victoria the vessels of all nations gathered to load and unload their cargoes.

Hongkong is a British crown colony, and, strictly speaking, its chief city, Victoria, cannot be classed with the open ports of China. But the trade which centers there is substantially a trade between China and foreign

¹⁶ Morse, *International Relations*, etc., Vol. 1, p. 43.

countries. The port is a place of shipment abroad of Chinese wares and a landing place for imports into China. The local consumption of Chinese and foreign goods is a negligible quantity compared with the volume which passes through the port. There are no statistics of this trade, but it is estimated to be about one-half that of Shanghai. There is, however, a record of the shipping, the tonnage of which in 1906 amounted to 8,812,827 tons for vessels to and from foreign ports and 13,640,250 tons for coastwise shipping, a total of 22,453,077 tons, making it one of the largest ports in the world in amount of shipping.¹⁷

The colony was enlarged in 1860 after the second war with Great Britain by the cession of Kowloon on the mainland opposite Victoria. This made the whole area of the colony 29 square miles. A further addition was made in 1898 by the lease for 99 years of the hinterland of Kowloon and the waters of several bays and by the inclusion of a number of islands along the coast, making the whole area 1,031 square miles instead of 29. About one-half of the addition is water. The land area was increased nearly fifteen-fold.

In 1907 a contract was signed for the construction of a railway from Kowloon to Canton. This work is now completed.

CHINESE OVERLAND TRADE WITH RUSSIA

The foreign trade of China, however, is not confined to that which is carried on by sea; from ancient times there has been an important exchange of commodities over the land frontiers. The overland traffic which once added to the luxury of Antioch and the wealth of Constantinople ceased long ago, but Moscow fell heir to it, as is witnessed by the existence there of the Kitai Gorod, the quarter of the city where that trade was conducted. The first treaty¹⁸ which China ever signed with a European state, that of 1689 with Russia, provided that the subjects of either power might cross the frontier for purposes of trade. That of 1727 permitted a Russian caravan of not more than two hundred merchants to visit Peking once every three years and, during the interval between the triennial visits to Peking, allowed an exchange of commodities only (no silver to be used) at two places on the frontier.¹⁹ One of these, Mai-mai-cheng, is still a mart of some importance. It is just across the boundary from the Russian city of Kiakhta.

Trade at Kuldja, at Ili, and at Tarbagatai, in the extreme western part of Mongolia, began as early as 1847 without a treaty but was regularized

¹⁷ Morse, *International Relations*, etc., Vol. 2, p. 396.

¹⁸ For the text of all the treaties mentioned in this article see: *Treaties, etc., between Great Britain and China, and between China and Foreign Powers, and Orders in Council, etc., affecting British Interests in China*, 3rd edit., revised by G. G. P. Hertslet and E. Parkes, 2 vols., London, 1908.—EDIT. NOTE.

¹⁹ Morse, *International Relations*, etc., Vol. 1, p. 473.

by the treaty of 1851. Article V of the treaty of 1860 with Russia permitted trade at Urga, the capital of Outer Mongolia, and at Kalgan, 135 miles north of Peking, at one of the passes through the Great Wall. The same treaty permitted caravans to visit Peking as often as they liked, provided not more than two hundred merchants were in any one caravan. This treaty also opened Kashgar, in the western part of Chinese Turkestan. The treaty of 1869 permitted merchants to proceed for purposes of trade to all parts of Mongolia where Chinese officers were residing; and that of 1881 agreed to the appointment of Russian consuls to Kobdo and Uliassutai in western Mongolia, to Hami in eastern Turkestan south of the Tien Shan, to Urumchi and Kucheng in Zungaria, as well as to Turfan in the region of that name, and Suchow in the extreme northwestern corner of the province of Kansu. Turfan, however, it was expressly stated, was not open to the residence of foreign merchants.

PORTS OPENED AFTER THE SECOND WAR WITH GREAT BRITAIN

After the second war with Great Britain (1860), in which France participated, eleven more ports in China were opened, four on the great Yangtze River and seven on or near the seacoast. The former were Hankow, Kiukiang, Nanking, and Chinkiang; the latter were Newchwang in Manchuria, Tientsin, the gateway to the capital, Chefoo in Shantung, Swatow at the eastern extremity of Kwangtung province, of which Canton is the capital, Kiungchow in the island of Hainan, and two ports in Formosa now in the possession of Japan. Nanking, being in the possession of the Taiping rebels, was not opened; its opening did not take place until 1899.

On February 21, 1875, Augustus R. Margary, a British consular officer, was murdered in the province of Yunnan, on the southwestern frontier of China, out of which unfortunate incident came the British treaty of 1876. This provided for the opening of four more cities: Ichang and Wuhu on the Yangtze, Wenchow on the eastern coast, and Pakhoi on the southern.

After the war of 1884 between France and China which led to the annexation of Tonkin to Indo-China, pressure was brought to bear to force the opening of three ports on the southwestern frontier: Lungchow in Kwangsi, Mengtsz and Szemao in Yunnan.

The delimitation of the boundary between British India and Tibet by the convention of December 5, 1893, was made an occasion for asking for the opening of Yatung in Tibet as a trade mart. The following year, on March 1, another convention was signed delimiting the boundary between Burma and China and providing for an open town on that frontier. The town chosen was Tengyueh in Yunnan.

During that year China was at war with Japan. The treaty of Shimo-

noseki opened four interior cities to foreign residence and trade: two on the Yangtze, Chungking and Shasi; and two on the Grand Canal, Hangchow and Soochow.

On February 4, 1897, the frontier of Yunnan and Burma was rectified so as to give additional areas to Burma, and three cities on the Sikiang, or West River, were opened: Wuchow in Kwangsi, Shamshui and Kongmoon in Kwangtung.

SEIZURE OF KIAOCHOW BAY BY THE GERMANS

The treaty of Shimonoseki of 1895 between China and Japan had ceded to the latter the southern part of Manchuria. To this Russia, who had fixed her eyes on Manchuria, decidedly objected, advising Japan for the sake of the peace of the Far East to return the territory to China. France and Germany supported Russia in this protest. The very next year Russia demanded and obtained from China by way of compensation for her good offices the right to construct a railway, the Chinese Eastern, across northern Manchuria. There is reason to believe that she also contemplated the lease of Kiaochow Bay. Her fleet wintered there in 1896-1897. But Germany also wanted compensation and in the summer of 1897 examined the coast of China with a view to leasing a port for a naval station. Unfortunately for China, in November, 1897, a band of outlaws attacked and looted a village in southwestern Shantung. Several persons were killed, among them two German missionaries who happened to be spending the night in that village. There was no anti-foreign movement in progress; it was merely by chance that these two Germans were in the village. A German fleet immediately visited Kiaochow Bay, landed a force of bluejackets, and seized the forts. After securing China's assent to the payment of a money compensation and to the dismissal of the governor of the province, Germany also demanded and obtained the lease for 99 years of the waters of Kiaochow Bay, the islands in the bay, and two small pieces of territory—one on either side of the entrance. She also obtained the right to build a railway from the port to the provincial capital together with certain mining rights and other economic privileges in the province of Shantung.²⁰ The lease included the town of Tsingtao, which has since become a beautiful city. Kiaochow Bay was dredged and is now the finest harbor in China north of the Yangtze.

LEASES OF TERRITORY TO OTHER EUROPEAN POWERS

If Russia was maneuvered out of Kiaochow, she soon obtained an equivalent in the lease of the Kwangtung peninsula of southern Manchuria, with its two harbors, Port Arthur and Dalny, and the right to construct a railway from these ports to Harbin on the Chinese Eastern Railway.²¹

²⁰ W. W. Rockhill: *Treaties and Conventions With or Concerning China and Korea, 1894-1904*, Washington, D. C., 1904, p. 45.

²¹ *Ibid.*, p. 50.

Great Britain, jealous of Russia, demanded and obtained the lease of Weihaiwei, on the northern coast of Shantung opposite Port Arthur, as well as an enlargement of her Hongkong colony by the lease of certain neighboring islands and the extension, also by lease, of the territory of Kowloon on the mainland.²² France also asked and was granted compensation in a lease of the bay of Kwangchow-wan,²³ with adjoining territory. These leases were all granted in 1898.

In January of that same year the British Government had offered to make to China directly and officially a loan of £12,000,000 to enable the latter to pay the balance of the indemnity due Japan for the retrocession of southern Manchuria. Russia and France objected strongly to a loan by a single power, and in the end the government loan had to be abandoned. China then negotiated for a larger loan from the Hongkong and Shanghai Banking Corporation in conjunction with the Deutsch-Asiatische Bank.²⁴ The rejection by China of a loan from the British Government, which had once been accepted, was an affront for which Great Britain demanded compensation. A part of this compensation was a promise by China to open the city of Nanning in Kwangsi and a port in Hunan, which was afterwards decided to be Yochow on the Yangtze at the entrance to Tungting Lake.²⁵

CHINA'S VOLUNTARY OPENING OF CERTAIN PORTS

The demand by European powers for leases of territory in various parts of China and the international scramble for loans and railway concessions led to talk of the partition of China and aroused a very bitter feeling in the breasts of the Chinese people. It was the immediate cause also of the proposal by Secretary of State Hay of the policy of the "open door" and the direct incitement to the anti-foreign movement, miscalled the "Boxer" rising. Another result of importance was the adoption by the Chinese Government of a policy of voluntarily opening desirable ports so that they might remain under Chinese control. In accordance with this policy three ports were opened by China in 1898: Chinwangtao, the winter port of Tientsin; Woosung, at the mouth of the Whangpoo, where it enters the Yangtze; and Santuao, in Fukien. Subsequently other cities were opened on the same basis, five of them in all: Tsinan, the capital of Shantung, with Weihsien and Chowtsun in the same province as subordinate to the Tsinan customs, in 1904; Haichow, on the coast of northern Kiangsu, in 1905; and Changteh, in the province of Hunan, in 1908.

OPENING OF PORTS AFTER THE RUSSO-JAPANESE WAR

It was in the year 1904 that war broke out between Russia and Japan,

²² *Ibid.*, p. 58 and 60.

²³ *Ibid.*, p. 55.

²⁴ Morse, *International Relations, etc.*, Vol. 3, pp. 114-117.

²⁵ *Ibid.*, Vol. 3, p. 124.

fought almost wholly on Chinese territory. In anticipation of this the United States Government in its commercial treaty of 1903 secured the opening of Mukden and Antung in Manchuria. At the same time Japan in a similar treaty asked for the opening of Tatungkow at the mouth of the Yalu in Manchuria. After the treaty of peace with Russia had been signed in 1905 Japan by convention with China obtained a recognition of the former's succession to Russian rights in southern Manchuria and persuaded China to open 18 more places in northern and southern Manchuria: Manchouli, Hailar, Tsitsihar, Aigun, Sansing, Suifenhö, Harbin, Hunchun, Junchingtsun, Ninguta, Kirin, Changchun, Fakumen, Tungkiangtze, Tiehling, Hsinmintun, Liaoyang, Fenghwangcheng.

While Russia was busily engaged in the war with Japan Great Britain sent Younghusband to Lhasa and won thereby a privileged position in Tibet. The convention signed in 1904 was, with some modifications, ratified by China in 1906. In accordance with its stipulations two more towns were opened in Tibet: Gyantse and Gartok.

In 1909 Japan and China had a misunderstanding concerning the status of certain Korean settlers in the Chientao region of eastern Manchuria. After some negotiation the matter was adjusted, and three more towns in that part of Manchuria were opened: Chützechieh, Totaokow, and Paitsaokow.

In 1914 China was further persuaded by Japan to open the new port being constructed at the head of the Gulf of Chihli, Hulutao, and five places in the province of Chihli: Chihfeng, Dolon-nor, Kweihwacheng, Jehol, and Kalgan. The last-mentioned had long been open to Russians.

Among the "Twenty-one Demands" made upon China in 1915 by her neighbor were those for the opening of additional towns in Shantung and in eastern Inner Mongolia. Ten were selected in Shantung: Kiaochow, Lungkow, Tsingtao, Tehchow, Lintsingchow, Yangkiokow, Tsining, Yenchow, Ichow, and Poshan. Eight were added for eastern Inner Mongolia: Chichüan, Kailuhsien, Hsiao Kulun, Linsi, Talai, Chinpeng, Pingchüan, and Wuchanghsien.

The opening of Wanhsien in Szechwan was provisionally granted in the British treaty of 1902, but the stipulations were not fulfilled and the right lapsed. Subsequently in 1917 the Chinese government opened the place upon its own initiative.

Thus there are not less than 107 cities and towns of China open to foreign residence and trade.

Survey of Foreign Trade of the Various Provinces and Cities

CANTON AND ITS TRIBUTARY PROVINCES, KWANGTUNG AND KWANGSI

Canton,²⁶ which for so many centuries held a monopoly of the foreign

²⁶ Population, 1917, 900,000; whole trade, Tls. 102,844,940; direct foreign trade, Tls. 77,868,466. The *shikwan* tael in 1907 was worth U. S. \$1.03. Trade statistics here and elsewhere in this article refer only to the trade passing through the Maritime Customs.

trade, has yielded the scepter to Shanghai. Nevertheless, it must always continue to be a port of importance, since it is the heart of the great delta formed by the junction of the North, West, and East Rivers. It has a population of a million in round numbers and is the metropolis of Southern China. By the waterways of Kwangtung and Kwangsi it gathers to itself the greater part of the trade of the two provinces. Kowloon, opposite Hongkong, Lappa, the customs station of Macao, Samshui and Kongmoon in the delta, Wuchow on the West River, and Nanning and Lungchow, on the upper waters of that river, are all tributary to Canton. Nanning has recently taken the place of Kweilin as the capital of Kwangsi. Lungchow was opened because it was expected that the railway from Hanoi to Langson in French Indo-China would be extended to that city. This has not yet been done. Although the place is near the frontier, it is separated from Langson by lofty ranges of mountains. The city lies in the midst of magnificent scenery, but the broken character of the country, which contributes so much to its picturesqueness, discourages railway building. Roads suitable for motor cars, however, are under construction. The trade of Lungchow is negligible in quantity. The old factory sites of Canton were long ago abandoned. Since 1859 the foreign settlement has been located in two concessions, one British, the other French, on the island of Shameen.

Except in the Canton delta the two provinces, Kwangtung and Kwangsi, are for the most part very mountainous. Kwangsi is wild and sparsely inhabited. It is notorious for the disorderly character of its inhabitants, who are much given to brigandage. Two-thirds of them are but semi-civilized and belong to non-Chinese races: the Miao and the Shan. Kwangtung, on the other hand, is rather densely populated. A recent census²⁷ gives over 31,000,000, an average of 318 to the square mile. Over half of these are pure Chinese. Other races are represented, such as the Miao, the Yao, and the Tung-Chia, or cave dwellers. Both provinces lie partly within the tropics, but except in the narrow valleys of southern Kwangsi, where the heat is enervating, the climate is tempered by the cool, dry winds of winter. The Cantonese, therefore, are a hardy, enterprising people. The mineral resources of the two provinces are believed to be considerable but are very little developed. The agricultural products are varied. Sugar cane, rice, cotton, tobacco, and tea are among the most important. Silk and grass cloth are produced in considerable quantities, and these, together with matting, fans, cassia, and tea, are among the principal exports shipped from Canton.

OTHER PORTS OF KWANTUNG PROVINCE

Pakhoi, in the southwestern part of Kwangtung at the head of the Gulf of Tonkin, serves the portions of the two provinces that are not within easy

²⁷ L. Richard: *Comprehensive Geography of the Chinese Empire and Its Dependencies*, transl. by M. Kennelly, Shanghai, 1908, p. 202.

communication with Canton. Aniseed, aniseed oil, tin, and indigo are among its exports.

The island of Hainan is also a part of Kwangtung Province. Its one open port, Kiungchow,²⁸ trades chiefly with Hongkong. Its principal exports are sugar, pigs, poultry, and betel nuts. The island is mountainous and is occupied in the interior almost wholly by the aborigines, the Li, believed to be related to the Siamese.²⁹ About two millions of Chinese are in possession of the coast. The fauna and flora of the island are tropical in the main but not wholly so. There are large deer to be found there and also monkeys and venomous snakes. Coconuts, palms, and pineapples are abundant.³⁰

Kwangchow-wan, the port leased to France, is also in Kwangtung Province. It has a good harbor, but the entrance to the bay is difficult. The French Government, it appears, has done nothing to improve the port or develop the region to which it gives access; but French occupation of the port prevents its use by any one else who might make it a rival to Haiphong,³¹ the chief port of French Indo-China.

Swatow,³² in the eastern part of Kwangtung Province, serves a limited district in the valley of the Han River. A railway connects the port with the city of Chaochow, 30 miles distant. Its trade is of considerable value. The chief exports are tobacco and sugar. Large quantities of sugar are shipped to Hongkong for refining. The people of Swatow are very enterprising and are found engaged in trade in many parts of China. They are extremely clannish, and the guild³³ of Swatow absolutely controls the town. It is not only a chamber of commerce but a municipal council as well; and, not content with controlling its own port, it maintains direct connection with organizations of Swatow men in other cities and uses its influence to protect and promote the interests of fellow townsmen wherever they may be.

FUKIEN PROVINCE

Fukien, the province opposite the island of Formosa, has three open ports: Amoy,³⁴ Foochow,³⁵ and Santuao.³⁶ The province is one of the smallest but is densely peopled. With an area of 46,332 squares miles it claims a population of over 22,000,000. This density of population in a mountainous region compels emigration. It is estimated that as many as

²⁸ Population, 35,000; its port, Hoihow, adds 25,000; whole trade, 1917, Tls. 5,917,094.

²⁹ P. G. von Möllendorff: *Foreign Languages Spoken in China*, *China Mission Handbook*, 1896, p. 49.

³⁰ Richard: *Comprehensive Geography of the Chinese Empire*, p. 206.

³¹ H. B. Morse: *The Trade and Administration of China*, revised edit., London, 1913, pp. 268-269;

idem, *International Relations*, etc., Vol. 3, p. 113.

³² Direct foreign trade in 1917, Tls. 23,319,723; whole trade, Tls. 51,900,351.

³³ H. B. Morse: *The Gilds of China*, London, 1909, pp. 53-57.

³⁴ Population, 300,000; whole trade in 1917, Tls. 14,602,519; direct foreign trade, Tls. 9,846,297.

³⁵ Population, 624,000; whole trade reported at customs in 1917, Tls. 15,223,269; direct foreign trade, Tls. 6,747,882.

³⁶ Population, 8,000; whole trade reported at customs in 1917, Tls. 2,502,562; direct foreign trade, Tls. 27,793.

200,000 men every year leave Amoy for the Philippines, the Straits Settlements, and other parts of the East Indies. The coast is deeply indented and has a number of fine harbors. The people are bold seamen, and many are engaged in fishing. Shut in as they are by the mountains, they preserve a dialect quite different from any other in China. Besides the Chinese, two aboriginal races inhabit the province: the Tung-chia and the Hsük'o. The latter are said to have brown hair.

The mineral resources of the province are believed to be important, but they are undeveloped. Japan claims Fukien to be within her sphere of interest and is unwilling that others should make investments there. Among the agricultural products are tea, rice, oranges, sugar, ginger, and camphor. Silk and paper are manufactured in large quantities, and Foochow in particular is noted for its lacquered ware. Tea is the principal article of export; but the trade has declined, partly owing to the growth of the demand for India teas but also because the opening of other ports on the coast and on the Yangtze has made it possible for the interior provinces to find easier routes to the sea. The mountain ranges are parallel to the coast, and this makes communication with the interior difficult. The ports therefore have not the importance that attached to them in the early days of foreign trade when the porcelains of Kiangsi were carried over the mountains to Marco Polo's Zayton.³⁷ This has been identified with the present Chüanchow, which once had an excellent harbor, now inaccessible because of sand bars. Amoy is close at hand and takes its place. Zayton, according to some authorities, gave us the word "satin."³⁸ But the manufacture of silks and satins for which that district was once noted seems to have declined. The foreign settlement at Amoy is on the island of Kulangsu in the harbor. The Japanese have been granted a site on the mainland for a separate settlement.

Foochow is situated on the picturesque Min River about 34 miles from its mouth. It cannot be reached by steamers, which are compelled to anchor nine miles below the city at Pagoda Anchorage, where also are found the arsenal and the government dockyards. Santuao has one of the finest harbors in the world, but it is shut in by mountains and serves a very small district, whose principal product is tea. The place was opened to prevent its being seized by some foreign power. The Chinese Government in 1913 was desirous of establishing a naval base there but met with opposition from Japan.

CHEKIANG PROVINCE

The province of Chekiang, which adjoins that of Fukien on the north, also has three open ports: Wenchow,³⁹ Ningpo,⁴⁰ and Hangchow.⁴¹ The

³⁷ Yule, *Marco Polo*, Vol. 2, p. 243.

³⁸ *Ibid.*, Vol. 2, p. 241.

³⁹ Population, 124,544; whole trade in 1917, Tls. 3,232,222; direct foreign trade, Tls. 11,846.

⁴⁰ Population, 470,000; whole trade in 1917, Tls. 25,107,523; direct foreign trade, Tls. 2,707,630.

⁴¹ Population, 684,137; whole trade in 1917, Tls. 21,020,832; direct foreign trade, Tls. 136,546

Province is the smallest in China. It contains 36,680 square miles and has between 11,000,000 and 12,000,000 inhabitants. The mountains of Fukien, known as the Tayü Ling, continue into this province and, crossing it from southwest to northeast, terminate in the sea, forming the Chusan Archipelago, opposite Ningpo.⁴² The province is thus divided into two nearly equal parts, whose fauna, flora, and population differ considerably. The southern part is mountainous, and its products, as well as the dialects and customs of the people, resemble those of Fukien. Wenchow serves this region. Situated on a river called the Ngo Chiang a few miles from the sea, it is a clean and beautiful port, with numerous canals, which have caused it to be likened to Venice.⁴³ But it is unimportant commercially. It was once a great tea port, but deterioration in the quality of the tea led to loss of trade.

The northern part of the province slopes into the great alluvial plain, the delta of the Yangtze River, which extends from Hangchow Bay to the northern part of Kiangsu Province and from Chinkiang to the sea. In this northern part of Chekiang we find dialects similar to those of the Yangtze region, and the pursuits of the people are identical with those of Kiangsu—the cultivation of rice and cotton and the production and manufacture of silk.

The principal exports of the province are silks, satins, rice, orange drying, fans, and furniture.

THE CITIES OF HANGCHOW AND NINGPO

Hangchow is the capital of the province and was once the capital of the nation. It is Marco Polo's Kinsay, which was but another way of saying "King-tzu" or "Capital."⁴⁴ It is coupled by the Chinese in a well-known proverb with Soochow as forming together the two most beautiful cities in the world.⁴⁵ The great city, with its interesting shops, its temples and mosques and pagodas, and its picturesque surroundings, particularly the Western Lake with its pleasure resorts, is an attractive place and before the ravages of the Taipings must have been even more beautiful than now.

It is the southern terminus of the Grand Canal and lies at the head of Hangchow Bay. It can never be a great seaport, however, because of the bore in the bay, which makes navigation too dangerous. The bore is due to three causes: (1) the funnel shape of the bay, 60 miles wide and of great depth at its mouth, narrow and shallow at its head; (2) the large area of sand flats at the head of the bay; and (3) the current of the Tsiengtang

⁴² Richard, *Comprehensive Geography of the Chinese Empire*, p. 228.

⁴³ Morse, *Trade and Administration of China*, p. 252.

⁴⁴ Yule, *Marco Polo*, Vol. 2, p. 149.

⁴⁵ The proverb, a couplet, has been translated:

"Above is heaven's blue;
Below are Hang and Soo."

River. The incoming tide meets the outgoing current of the river, and seen at its best, the bore is a wall of water sometimes 19 feet in height traveling at the rate of 15 miles an hour.⁴⁶ Because of this obstruction to navigation the seaport of the district is Ningpo, near the mouth of the bay on the Yung River about 15 miles from the sea.

Ningpo is the Liampo⁴⁷ of the sixteenth century and the Mingchou and Ch'ingyüan⁴⁸ of earlier times. Although there was a flourishing colony of Portuguese there in the sixteenth century, the reopening of the port in 1843 did not lead to the trade development expected. The British were in possession of the Chusan Archipelago at the entrance to Hangchow Bay from 1841 to 1846. Ningpo had every chance to become the commercial capital of China under such favoring conditions; but its guilds were illiberal in their attitude towards foreign trade, and the prize passed to Shanghai. Today Ningpo is commercially a dependency of Shanghai, with which poor daily communication is maintained by coasting steamers. A railway is to connect Ningpo with Hangchow. The latter city is already connected with Shanghai by railway as well as by canal and river.

KIANGSU PROVINCE AND THE SHANGHAI REGION

Kiangsu Province, which embraces most of the delta of the Yangtze, has six open ports: Shanghai, Woosung, Soochow, Chinkiang, Nanking, and Haichow.

Shanghai,⁵⁰ the commercial metropolis of China, is situated at the junction of the Hwangpu and Woosung Rivers, the latter now known as Soochow Creek. Some five hundred years ago these two streams were united by a canal which now is regarded as the main channel of the Hwangpu River. The west bank of this canal is the Bund, the principal street of the foreign settlement. From the foreign settlement to the mouth of the river the channel was originally that of the Woosung River, but the latter is now considered a portion of the Hwangpu. The stream empties into the mouth of the Yangtze at the town of Woosung, some fourteen miles below Shanghai. The largest ocean-going steamships usually anchor at this point and do not ascend the river to Shanghai without lightering the cargoes. The Protocol of 1901, entered into after the "Boxer" trouble, provided that measures should be taken to improve the channel of the Hwangpu.⁵¹ By the straightening of the channel and by dredging operations navigation has been made much easier. There is now maintained at low water a depth of 24 feet on the inner bar.

⁴⁶ Commander Moore: *The Bore of the Tsien-tang Kiang (Hang-chau Bay)*, *Journ. North China Branch of the Royal Asiatic Soc.*, Vol. 23, N. S., 1888, pp. 185-247; reference on pp. 216 and 218.

⁴⁷ Yule, *Marco Polo*, Vol. 2, p. 239, note.

⁴⁸ Chau Ju-kua, pp. 18 and 20.

⁴⁹ Morse, *Trade and Administration of China*, p. 252.

⁵⁰ Population about 1,000,000, of whom 18,519 are foreigners (Japanese 7,169, British 4,822, American 1,307); foreign trade in 1917, Tls. 407,440,649.

⁵¹ The provisions of the Protocol were amended in 1905, and the work was begun in 1906.

The whole region about Shanghai, from the Grand Canal to the sea and between the Yangtze and Hangchow Bay, is a vast alluvial plain very little elevated above the level of the sea except where here and there a hill, once an island in this great delta of the Yangtze, lifts itself above the plain. This plain is intersected in all directions by numerous canals, which afford easy communication between the numerous cities and towns of the district and facilitate the transport to market of the products of the fertile soil and the manufactures of a skillful and industrious population.⁵² A sea wall protects the coast lands in many places. Every foot of ground appears to be utilized. The soil is of inexhaustible fertility. The principal field crops are rice and cotton. Mulberry orchards abound for the feeding of silkworms. The silk produced is of the very finest. The reeling, spinning, dyeing, and weaving of the silk give employment to millions and constitute one of the chief industries of this region. The fertile soil is not the only dependence of the farmer; the waters of the canals, lakes, and rivers are so made to contribute to his wealth. They are stocked with fish which are taken in nets or caught with cormorants, and the less frequented canals are planted with water chestnuts,⁵³ the lotus, and other aquatic plants.

SHANGHAI

Shanghai consists of three separate municipalities: the old native city, which dates from 242 B. C. and which, with its narrow ill-smelling streets, was until recently enclosed within its own walls; the French Concession, immediately to the north of the city and formerly separated from it by the moat; and the International Concession north of the French Concession. A few years ago the wall around the native city was removed, and the moat filled up. This made possible the construction of a boulevard around the old town. The French Concession was formerly separated from the International Concession by a creek, the Yangkingpang, which has since been converted into a covered sewer. These are great improvements, contributing much to the sightliness of the city and perhaps to its sanitary betterment, although Shanghai has always enjoyed a good reputation for healthfulness.⁵⁴ The three municipalities cover an area of ten or twelve square miles. The foreign settlements are well provided with good water, gas, and electricity; and the macadamized streets and suburban roads are kept in excellent condition. Railways connect the settlements with the port of Woosung and with Hangchow and Nanking. Daily communication is maintained by steamers with the towns on the Yangtze and scarcely less fre-

⁵² The Hwangpu, it is estimated, drains 12,000 square miles.

⁵³ The water chestnut is the *Scirpus tuberosus*. Both the seeds and the root of the lotus are eaten. The latter has been introduced into the United States under the name "tasheen."

⁵⁴ Recent statistics give the mortality of Shanghai as 15.4 per thousand. The thermometer ranges from 25° to 103° F. The mean temperature for a period of 8 years was 59.1° F. During the same period the average annual rainfall was 43.46 inches and the average number of rainy days 124.

quently with the ports on the coast. The flags of all maritime nations are seen on the shipping in the river, and a forest of masts along the wharves of the native city mark the landing place of junks from all parts of China.

OTHER PORTS OF KIANGSU PROVINCE

Soochow,⁵⁵ the sister city of Hangchow, is connected with Shanghai both by water and by rail. It is situated on the Grand Canal about 80 miles from Shanghai and close to the shore of the Great Lake. It is noted for its pagodas and for its manufacture of silk.

Chinkiang⁵⁶ is at the crossing of the Yangtze and the Grand Canal about 150 miles from the mouth of the great river, of which it is regarded as the gateway. Silver Island and Golden Island with their monasteries add to the beauty of the scenery there. The advantageous location of the port makes it a desirable place for the gathering and distribution of exports and imports.

Nanking⁵⁷ is a city of great historic interest, having several times been the capital of the old empire. It was for years the capital, too, of the Taiping rebels and more recently the first meeting place of the republican parliament. The city wall, which varies in height from 50 to 60 feet, encloses a larger area than that of Peking. It has a circuit of 24 miles. The ancient beauty of the place has been much marred by the destruction wrought by the Taipings and by more recent fighting, but the quiet roads that wind about among the grave-clad hills of the northern part of the city disclose many picturesque spots where Buddhist and Taoist abbeys and monasteries are hidden among the bamboo groves. The foreign settlement lies outside the walls, at Hsia-kwan, which is the steamer landing. The Shanghai-Nanking railway has its terminus there and connects by ferry with Pukow across the Yangtze, the southern terminus of the Tientsin-Pukow railway. The trade of Nanking is of no great importance, but its silk factories were once famous. It is today a great educational center and the seat of the provincial administration.

Haichow, as yet, has had no development as a port; but it was selected as the seaward terminal of the trunk line railway for which certain Belgian and French interests hold a contract and which is to connect the far north-west and Turkestan with the sea. The city lies in the northern part of the province near the Shantung boundary. The harbor is a poor one but is sheltered by Pearl Island and with dredging could probably be made suitable, but its proximity to Tsingtao and the proposed connection of the port with the railway just mentioned will likely make unnecessary

⁵⁵ Population, 500,000; whole trade in 1917, Tls. 18,927,756; direct foreign trade, Tls. 24,101.

⁵⁶ Population, 168,309; whole trade in 1917, Tls. 18,014,171; direct foreign trade, Tls. 4,865,783.

⁵⁷ Population, 377,459; whole trade in 1917, Tls. 22,895,022; direct foreign trade, Tls. 4,360,029. Pukow, on the north shore of the Yangtze, opposite Nanking, is the terminus of the railway from Tientsin and should also be considered as an open port.

costly an undertaking. Shanghai, however, overshadows all other ports in Kiangsu.

Rice, cotton, and silk are among the principal products of the province; and its cotton piece goods, which in other days we knew as nankeen, were among our earliest imports from China. But Shanghai does not merely serve the province of Kiangsu. It is the port of entry and of shipment abroad for a great part of the trade of the whole country. The Yangtze ports in particular are tributary to the commerce of Shanghai.

THE MIDDLE YANGTZE VALLEY

The great Yangtze valley is the heart of China, its richest and most populous region. The Yangtze Kiang is formed by four rivers flowing through a province which from that circumstance gets its name, Szechwan (Four Rivers). It is the largest of all the provinces, containing 218,533 square miles, and is bounded on the west by the dependency of Tibet. Its population is variously estimated at from 40,000,000 to 70,000,000.

The chief port of the province is Chungking, situated on a rocky promontory at the confluence of the Kialing (also called "the Little River") with the Yangtze (known there as "the Great River"). It is a rich and busy city⁵⁸ with an estimated population of 300,000 to 600,000. The only other city in the province open to foreign residence is Wanhsien, about half-way between Chungking and Ichang.

Ichang, one of the open ports of Hupeh Province, is situated ten miles below the lower entrance to the gorges, about 350 miles down river from Chungking and 370 miles above Hankow; it used to be the head of steam navigation on the Yangtze. Above that port cargoes had to be carried in junks of about 25 tons' capacity. The junks were dragged slowly and painfully up the rapids by human labor. Three weeks was the least amount of time needed for the voyage of 350 miles, and a month was more often consumed. Recently, however, shallow-draft steamers have been built especially for this trade which are able to stem the swift current and which reduce the passage from Ichang to Chungking to days instead of weeks. Ichang⁵⁹ is still scarcely more than a port of transshipment. To Americans Ichang is of interest as the eastern terminus of the American section of the Hankow-Szechwan Railway⁶⁰ under construction as one of the Hukwang Railway lines. Its population is but 45,000.

A more important commercial mart is Shasi,⁶¹ about 100 miles farther down the river, also in Hupeh Province. Its river front is densely crowded for two or three miles with junks anchored side by side. Behind the port a network of canals and lakes affords communication in many directions

⁵⁸ Whole trade, Tls. 33,592,533; direct foreign trade, Tls. 912,764.

⁵⁹ Whole trade, Tls. 5,685,589; direct foreign trade, Tls. 246,271.

⁶⁰ See the note "A Proposed Railroad to Tap the Red Basin of Szechwan, China," with map, 1:5,700,000 in *Geogr. Rev.*, Vol. 7, 1919, pp. 184-186.—EDIT. NOTE.

⁶¹ Population, 105,000; whole trade, Tls. 4,422,849; direct foreign trade, Tls. 285,215.

through the triangular plain that lies between the Yangtze and the Han River and reaches to Hankow.

HANKOW

It is Hankow⁶² that is the chief port of the province of Hupeh and indeed the great commercial capital of central China. Hankow has been called the Chicago of China and not inappropriately so. The name means "the mouth of the Han." Lying at the junction of the Han with the Yangtze, it is separated by the Han from the city of Hanyang and by the Yangtze from Wuchang. Hanyang is the site of a government arsenal and of the iron furnaces and rolling mills of the Han-ye-ping Company; Wuchang is the provincial capital. The three cities together have a population of about 1,000,000. Ocean-going steamships are able to reach Hankow, 630 miles from the sea, except in seasons of very low water. Hankow is also destined to be a great railway center; a trunk line connects it with Peking, 754 miles to the northeast; and it is also the headquarters of the Hukwang Railways, which, when the war broke out, were being built by the "Four-Power Group." German interests have since been eliminated. Two main lines are being planned, one from Hankow westward into Szechwan and the other southward towards Canton. The latter will connect with the line being built northward from Canton by a Chinese company. There is at present a gap of about 280 miles between the two railheads. The iron for the blast furnaces at Hanyang is brought from the Tayeh mine about 70 miles down the river; the coal comes from the Pingsiang mines in Kiangsi Province near the border of Hunan, whence it was transported until recently by rail to the Siang River and then by boat to Hanyang. Now that the Hankow-Canton Railway has been completed to Siangtan and beyond, an all-rail route is available as far as Wuchang, just across the river from Hanyang. Hankow is also one of the principal tea markets of China. There are large tea-firing establishments there, where the tea is prepared for export, and presses for the manufacture of brick tea that is shipped to Russia. Other exports are pig iron, wood oil, cotton and cotton yarn, jute, hides, skins, furs, vegetable tallow, and tobacco. The pig iron is mostly shipped to Japan. The wood oil is imported in large quantities into the United States, for the manufacture of varnish. It is expressed from the nuts of the *Aleurites cordata*. The cotton yarn is manufactured in Wuchang, where the late Viceroy, Chang Chih-tung, built a modern cotton mill. Hankow is one of the ports afflicted with too many concessions. Five foreign governments have established settlements there, each with its own municipal organization: British, Russian, French, German, and Japanese. The Chinese Government, upon the declaration of war against

⁶² Whole trade for 1917 passing through the Maritime Customs, Tls. 170,730,067; direct foreign trade, Tls. 49,523,054.

Germany, seized and occupied the German Concession.

HUPEH AND HUNAN PROVINCES

Hupeh means "North of the Lake"; Hunan means "South of the Lake." The lake to which reference is made is Tungting Lake, which is situated just inside the northern boundary of Hunan. These two provinces were formerly included in one administration known as the "Hukwang." The province of Hupeh is mountainous in the northwest, but one-half of the province is a fertile plain. Hunan is wholly mountainous except in the vicinity of Tungting Lake. Hunan is rich in minerals, the most important of which are coal and antimony. In the southern part of the province the coal is anthracite, but further north are excellent deposits of bituminous. The largest deposits of antimony in the world are said to be found in this province. Other minerals are gold, silver, iron, copper, lead, and zinc; but there is very little mining by modern methods. Among the important exports are tea, coal, antimony, and wood. There are three open ports in the province: Changsha,⁶³ the capital, an important city of 250,000 inhabitants; Yochow, a small place of some 20,000 inhabitants, near the outlet of Tungting Lake; and Changteh, on the Yuan River, west of Tungting Lake, a city of about 150,000 inhabitants.

KIANGSI PROVINCE

One of the ancient overland routes from north to south passes through Hunan and crosses Cheling Pass into the province of Kwangtung. The Hankow-Canton Railway in the main follows this old road. But the route known as the "Ambassadors' Way" passes through the province of Kiangsi and crosses the range by Meiling Pass. This province, like its neighbor on the west, is mountainous; but Poyang Lake, connected with the Yangtze, in the northern part of the province and the Kan River, which flows into the lake from the south, furnish water communication for small steamers as far as the capital, Nanchang, and for smaller native boats as far as Nanan in the southern part. This is the province in which the celebrated Imperial Potteries are situated, no longer "Imperial" but still national property. In these potteries at Kingtehchen the finest porcelain in the world is made. The word "kaolin," by which we designate the material from which porcelain is made, is nothing more than the two Chinese words, "kao lin" (high ridge), the name of the hills from which the clay is obtained.

Kiukiang⁶⁴ is the only open port in the province, situated on the Yangtze River near the outlet of Poyang Lake. It is noted for its manufacture of fine silverware, its porcelain shops, and its tea factories. In the mountains

⁶³ Whole trade in 1917, Tls. 27,492,228; direct foreign trade, Tls. 1,358,882.

⁶⁴ Population, 36,000; whole trade in 1917, Tls. 41,936,034; direct foreign trade, Tls. 2,145,086.

not far away the foreign residents of central China have established a summer resort, called Kuling. A railway recently completed connects Kiukiang with the provincial capital, Nanchang.

Continuing our descent of the river, there is but one other open port that remains to be mentioned, Wuhu,⁶⁵ in the province of Anhwei. This is the great rice port of China. It is a rather unsightly town of about 137,000 inhabitants.

There are several other cities on the Yangtze at which foreign steamers are allowed to touch, but only to land or ship passengers and their baggage. This valley of the Yangtze comprises an area of 700,000 square miles and is inhabited by some 200,000,000 people. It is here that the foreign merchant finds his best market.

SHANTUNG

Between the mouths of the Yangtze Kiang and the Hwang Ho the promontory of Shantung lifts itself above the great plain and carries the coast line far out towards the east. The province to which the name Shantung is applied is mountainous in the eastern part but level in the western. It is the most densely populated province in China. It contains 56,000 square miles and 37,000,000 inhabitants. It is the holy land of the Chinese,⁶⁶ the birthplace and the burial place of their two greatest sages, Confucius and Mencius, and overshadowed by the sacred mountain, Tai Shan. The principal minerals are coal, iron, gold, and gypsum. There are also deposits of copper and lead. An American company is operating a gold mine in the province. Fourteen cities and towns in the province have been opened to foreign residence and trade, nine of them only since the presentation of the "Twenty-one Demands" by Japan in 1915. The oldest open port is Chefoo,⁶⁷ on the northern coast. It was once a port of some importance, and its beach attracted the foreign residents of China in the summer time. But the seizure of Kiaochow Bay by the Germans in 1897 and the development of Tsingtao⁶⁸ together with the construction of the Shantung Railway connecting Tsingtao with the provincial capital Tsinan, 254 miles inland, has drawn off a large share of the trade that formerly found an outlet at Chefoo. Tsingtao has a splendid, well-sheltered harbor, Chefoo an open roadstead. Tsingtao has rail connection with the interior, Chefoo is cut off by mountains from the hinterland. Efforts are being made by the people of Chefoo to overcome these handicaps by the building of a breakwater for the port and by the construction of a railway that will facilitate communication with inland cities. It is confronted now by another handicap scarcely less serious, the opening of Lungkow, a neighboring port, upon the demand of the Japanese, and the building of a

⁶⁵ Population, 108,610; whole trade, Tls. 19,447,194; direct foreign trade, Tls. 1,553,393.

⁶⁶ See the article "Shantung," *Journ. of Geogr.*, Vol. 18, 1919, pp. 312-316.—EDIT. NOTE.

⁶⁷ Population, 54,450; whole trade in 1917, Tls. 32,233,419; direct foreign trade, Tls. 12,722,356.

⁶⁸ Population, 77,052; whole trade, Tls. 57,782,991; direct foreign trade, Tls. 34,723,973.

railway from this new port to connect with the Shantung Railway, now also under their control.

JAPAN'S ESTABLISHMENT OF A FOOTHOLD IN SHANTUNG

In August, 1914, as is well known, Japan presented an ultimatum to Germany, demanding the surrender of the German leased territory of Kiaochow, to be handed back "eventually" to China. No response having been made by Germany, in September Japan invaded the province of Shantung from the port of Lungkow on the northern shore, a hundred miles from the nearest point in the leased territory, in utter disregard of China's rights as a neutral and in spite of China's protests. Great Britain found no difficulty in landing her forces in the leased territory. China, finding her protests unavailing, declared a zone of belligerency, extending a hundred miles west of the boundary of the leased territory. But Japan disregarded this also. After marching across neutral territory, seizing telegraphs and post offices, billeting her troops upon the unwilling Chinese peasants and killing those who resisted, she seized the Shantung Railway; but, instead of confining her operations to the belligerent zone and turning her face towards Tsingtao, she marched westwards to Tsinan and took possession of the whole line. After the surrender of Tsingtao she established civil government at various points along the line, in places far from the leased territory. This, of course, was a violation of China's sovereign rights. After the capture of Tsingtao, there being no further need of military operations in Shantung, China abolished the zone of belligerency and requested Japan to withdraw her troops to the vicinity of the leased territory, where alone they had any right to be.

JAPAN'S "TWENTY-ONE DEMANDS" ON CHINA

Japan claimed that this was an unfriendly act and presented the notorious "Twenty-one Demands." Under dire threats she warned China to keep them secret and gave out to the foreign powers that there were but eleven demands, concealing in this way the most offensive. After months of negotiation and after having landed in China two additional divisions of troops, Japan issued an ultimatum. As usual, China was unprepared and had to yield to the greater part of the demands. Among other things the demands included one to the effect that China should give assent to any arrangement which Japan might make with Germany as to the disposition of her former rights in Shantung. In an exchange of notes annexed to the convention Japan agreed that, when she should obtain the free disposition of the leased territory, she would return it (but not the railway, mines, or other economic rights) to China upon condition that Japan have a concession under her exclusive jurisdiction at some place within the leased territory. Other conditions were that the whole of

Kiaochow Bay was to be opened as a commercial port, an international concession to be established if desired by other foreign powers, and the disposition of German properties to be arranged by China and Japan by mutual agreement before the restoration.

This is the promise which Japan has repeatedly said since the Peace Conference she means to keep. To the careless observer it reads as though something of worth were to be returned to China. But, if carried out as expressed in this agreement, it means merely that in exchange for a lease which still has 78 years to run Japan will receive a perpetual lease to the only part of the leased territory that is worth anything, i. e. to the city and port of Tsingtao—a concession under her exclusive jurisdiction. In addition to this the Shantung clause of the treaty gives her the properties of Germany, concerning which she was to arrange with China after the Peace Conference.

THE SHANTUNG RAILWAY

In September, 1918, the Chinese Government, in order to get rid of the civil government established by Japan along the Shantung Railway outside the leased territory, agreed in a convention with Japan to have the railway converted into a Sino-Japanese enterprise. It was stipulated that the railway should be policed by Chinese under the direction of Japanese “instructors” (euphemism for “officers”). At the same time in another convention China agreed in return for a loan to grant to Japan the option formerly held by Germany on the extension of the Shantung Railway westward and the construction of a branch line that will connect Tsingtao with the great trunk line railway that is being built from the coast into north-western China, where it is expected eventually to be extended to meet the Russian Central Asian Railway. Under the administration of Germany Kiaochow Bay became the finest harbor in northern China, and these projected rail connections will make it the most available outlet for the trade of northern and western China. At present the principal exports from Tsingtao and Chefoo are pongee, straw braid, bean oil, and peanut oil.

CHIHLI PROVINCE

North of Shantung lies the metropolitan province, Chihli, in which Peking,⁶⁹ the national capital, is situated. Peking is not an open city and therefore does not properly call for description in this paper. But large numbers of Europeans, Americans, and Japanese are living there, some of them for purposes of trade. They are there by sufferance, however, and not by right, except that the tolerance may be said to have created a prescriptive right.

⁶⁹ Population about 700,000.

The province of Chihli has seven open cities, the most important of which is Tientsin, the port for the capital. It is situated at the junction of four rivers: the Pei Ho, the Hun Ho, the Puto Ho, and the Laochang Ho, which together form the Hai Ho, emptying into the Gulf of Chihli at Taku 35 miles below Tientsin. The Grand Canal at Tientsin enters the Pei Ho, by which stream in olden times communication was had with Tungechow and Peking. A canal connects Tungechow with the capital. Now the journey from Tientsin to Peking, 84 miles distant, can be made by rail in three hours. This railway, the Peking-Mukden line, connects Tientsin also with the coal mines at Tangshan, about 80 miles to the northeast, and with Chinwangtao, 160 miles in the same direction near the terminus of the Great Wall. Chinwangtao is the winter port of Tientsin. When the Hai Ho is frozen steamers can still go alongside the pier at Chinwangtao. The Hai Ho had become so badly choked with silt by 1900 that the Protocol of 1901 provided for the organization of a conservancy board, which has since greatly improved the channel and by dredging increased the depth of water on the Taku bar. It was here, in the attack of the British and French upon the Taku forts in 1859, that the American Commodore Tattnall excused his violation of international law, the towing of boatloads of British marines into action, by declaring that "blood is thicker than water."

TIENTSIN

Tientsin,⁷⁰ however, no longer depends wholly upon water for communication with the outside world; it is connected by rail with Pukow, on the Yangtze opposite Nanking, 674 miles south, and via Tsinan with Kiaochow, 500 miles to the southeast. As a punishment for its part in the "Boxer" rising, Tientsin was deprived of its city wall, but it has been greatly benefited thereby. A wide boulevard with an electric street-car line has taken its place. Before the world war there were nine municipal governments functioning at Tientsin: that of the Chinese, with jurisdiction over the native city, and those of eight foreign governments, each presiding over its own settlement. These powers were Great Britain, France, Germany, Japan, Austria, Italy, Russia, and Belgium. After China entered the war the Chinese Government seized and occupied the Austrian and German concessions. Tientsin lies below the level of the sea at high tide but is protected by dykes. The floods of 1917 swept over these embankments and covered the city and settlements to the depth of several feet in places.

Tientsin is the headquarters of the Changlu salt district, from which great quantities of salt are distributed by the gabelle throughout northern China. The salt is evaporated by exposure of the brine to the sun in shallow vats in the plain. The sea water is pumped by windmills whose sails,

⁷⁰ Whole trade in 1917, Tls. 142,360,661; direct foreign trade, Tls. 70,887,522.

moving horizontally around a vertical shaft, present an odd appearance to the traveler.

When there were no railways Tientsin was the starting point of the caravans that conducted overland trade with Russia via Kalgan, Urga, and Kiakhta, as well as those that trafficked with Central Asia. This trade still has importance but only in so far as Mongolia and Chinese Turkestan are concerned. The through shipments to and from Russia find a more expeditious route over the Trans-Siberian Railway, which is reached by the Peking-Mukden and South Manchuria Railways.

The principal products of Mongolia, Turkestan, and northern China that find export at Tientsin are hides, hair, sheepskins, goatskins, wool, camels' hair, hemp, jute, cottonseed, rapeseed, linseed, beans, vegetable oils, salt, and the rugs for which Tientsin and Peking are celebrated. Coal is an item of increasing importance, and other articles of interest to American trade are rhubarb and licorice root.

MANCHURIA

Manchuria,⁷¹ the old kingdom of the Manchus before they conquered China, is commonly known among the Chinese as the "Three Eastern Provinces." These three provinces are (1) Heilungkiang (Black Dragon River), i. e. the Amur, (2) Kirin (Lucky Forest), and (3) Shengking (Prosperous Capital), the name also of the old capital of the kingdom. The area of the three provinces is 363,700 square miles. The population is perhaps 10,000,000 or 12,000,000. This is very unevenly distributed, three-fourths or more being found in the southern province, Shengking. The Manchus form a very small part of the population. Japanese immigrants are coming in in considerable numbers, but they do not amount to 100,000. The middle province, Kirin, is thinly populated, and the northern still more sparsely settled. The northern half of Manchuria is drained by the Sungari, its tributary the Nonni, by the Amur, and the Ussuri, all of which are navigable for hundreds of miles: the Amur for 450 miles by steamers drawing 12 feet of water and for 1,500 miles by boats drawing 4 feet; the Sungari as far as Kirin, about 600 miles from its mouth, and the Nonni for 150 miles beyond its junction with the Sungari. The southern half of the dominion is drained on the west by the Liao and on the east by the Yalu. The former is navigable for steamers as far as Newchwang, about 30 miles from its mouth, but for native boats throughout its whole course in Manchuria. The Yalu, which forms the boundary between Manchuria and Korea, is navigable in its lower course.

The whole of the three provinces is mountainous except the plains that are watered by the Sungari and the Liao. Much of the country has been

⁷¹ Richard, *Comprehensive Geography of the Chinese Empire*, Book II, Chapter 1 (pp. 486-508); Alexander Hosie: *Manchuria: Its People, Resources, and Recent History*, London, 1901.

very little explored. A large part of the soil has never been cultivated. In the north are extensive forests. In some parts there are stretches of pasture land. Where the soil is cultivated it is very fertile. The agricultural products are wheat, dura, the soy bean, millet, tobacco, hemp, and peas, and in the south rice and cotton also. A fine quality of pongee is produced also. This is manufactured from wild silk, as it is called, i. e. silk from worms that feed upon oak leaves. Beans, bean oil, and bean cake with the pongee make up a good part of the exports. Other articles of importance are furs and skins. The country is rich in minerals: gold, silver, coal, and iron. Copper and lead also are found. Mining is as yet little developed except that certain gold mines are worked by Chinese in the north, and coal mines by the Japanese along the South Manchuria and Mukden-Antung Railways.

MANCHURIAN RAILWAYS

There are two systems of railways in Manchuria. In the north the Chinese Eastern, constructed by Russians and leased to a Russian company, crosses from west to east, forming in fact a section of the great Trans-Siberian line. From Harbin on the line a branch extends to the south as far as Kwangchengtze (Changchun), where it connects with the Japanese system. But the Russian lines are of the broad gauge, while the Japanese railways have the standard gauge. This makes necessary a transshipment of passengers and freight at Kwangchengtze. The Russians have also the right to build northwards from Harbin to the Amur. The Japanese main line, the South Manchuria Railway, connects at Kwanchengtze with a branch line to Kirin and at Mukden with the Chinese line to Peking and with the Japanese Mukden-Antung Railway, which joins the Korean railway over the bridge at Antung spanning the Yalu River. The South Manchuria line has a number of small branches, and there is under construction an important branch via Chengchiatun to Taonanfu.

In this great region with its fertile soil, temperate climate, and wonderful mineral resources, a country which is still for the most part undeveloped and but sparsely settled, there are 29 open cities and towns in the Three Eastern Provinces, to which should be added 8 others in eastern Inner Mongolia, which geographically may be considered as belonging to the same region. Few of these, however, deserve special notice.

NEWCHWANG AND DAIREN

Newchwang⁷² has been opened longer than any other. For many years it was the only open port in Manchuria. It is situated on the Liao River about 30 miles above its mouth. The port is located about ten miles below the city at the village of Yingkow. Prior to the Russo-Japanese war Newchwang ranked fifth among the treaty ports in the value of its trade. But,

⁷² Population, 56,683; whole trade in 1917, Tls. 23,829,499; direct foreign trade, Tls. 7,883,798.

since that war gave Japan possession of Port Arthur and Dalny and led to the opening of many other towns in Manchuria, the importance of Newchwang has greatly declined. The development of the leased territory of Kwantung and the encouragement given to shipment over the South Manchuria Railway through Dalny (now Dairen) has placed Newchwang under a handicap. The improvement of the Liao River, which affords cheap water transportation into the interior, will lessen this handicap in some degree. This work has already been undertaken.

Dairen with its magnificent harbor is the principal port in the Japanese leased territory of Kwantung. During the world war its trade increased enormously by reason of the shipments by that route into Siberia. In 1917 it ranked second among the open ports of China.⁷³

OTHER PORTS IN MANCHURIA

Since the completion of the bridge over the Yalu River has given Japan the right to claim a reduction of duties on imports over a land frontier, in accordance with the precedent of Russo-Chinese overland trade, the importance of Antung has considerably increased. Antung is situated but 15 miles from the mouth of the Yalu, and vessels drawing from 8 to 10 feet of water can come up to its wharves. The Yalu lumber trade is an important one. There are also valuable mineral deposits in the vicinity, mostly undeveloped, among which American consular reports mention asbestos. Antung is distant 188 miles by rail from Mukden.

Mukden is more important politically than commercially, since it is the capital of the governor general; but, as intimated above, it is also an important railway center. To the traveler it is of interest as the site of the old Manchu palace and the tombs of early emperors of that dynasty.

A little-known region of Manchuria is the Yenchi district of Kirin Province on the Korean frontier in the valley of the Tumen River. It was practically uninhabited until 1886. Koreans began to immigrate into the district about that time but without the consent of China until 1892. There are now nearly 100,000 of them in western Yenchi. It is a region of fertile valleys separated by lofty ranges, with an excellent climate and undeveloped mineral resources. It is still very sparsely settled. There are five open towns in this district. The opening of Hunchun was provided for in the treaty of 1905 between China and Japan, and in 1909 four other towns were opened; Lungchingtsun, Chützechieh, Totaokow, and Paitsaokow. Chützechieh, a town of 3,000 inhabitants, is the principal place in the region. The *taotai* moved his official residence from Hunchun to Chützechieh in 1910.

Lungchingtsun,⁷⁴ on a branch of the Tumen River, is more favorably

⁷³ Whole trade, Tls. 135,945,180; direct foreign trade, Tls. 109,850,038.

⁷⁴ Population, 650; whole trade in 1917, Tls. 1,281,113.

situated than the others for trade with Korea. It is but 26 miles from the frontier but is separated by a range of mountains over which the traffic must pass. But at the frontier it connects by rail with the Korean port of Seishin. A railway is planned from Kirin to this region, a distance of 320 miles.

Kirin, capital of the province of the same name, is a city of 100,000 inhabitants and has some commercial importance. Its exports are tobacco, timber, and furs.

Harbin⁷⁵ is composed of three towns: the old Chinese city, the port on the Sungari, and the new settlement at the railway station, which is really a Russian city on Chinese territory. There are some large flour mills there, but trade has been much injured by the abolition in recent years of the free trade zone on the Russian side of the frontier.

CLASSIFICATION OF CHINESE OPEN PORTS

The open ports of China may be divided into five classes. In the first class are included those cities at which no area is set aside for the creation of a foreign settlement. Such a port is Chefoo.

The second class comprises those in which concessions in the nature of perpetual leases of land have been granted to one or more powers for the establishment of a settlement under the control of the lessee power, which issues deeds to the land renters but also pays a stipulated annual rent to China in recognition of Chinese sovereignty. In these concessions the police powers are exercised by the lessee. In some a municipal council is elected by those paying taxes of a certain amount, but all acts of the council must be approved by the consul of the lessee government. In other national settlements there is no council whatever; the control is exercised by the consul alone. Tientsin and Hankow are examples of this sort.

The third class embraces those ports where there have been created international settlements governed by the foreign residents themselves, who elect a municipal council that exercises the usual powers of such bodies. Shanghai and Amoy are ports of this sort. One objectionable feature at Shanghai is the exercise by absentee landlords of the right of suffrage. This is done by proxy, one person at times holding ten or a dozen proxies.

In the fourth class are placed those cities which have been opened by China upon her own initiative and with regulations adopted by her own government. At these ports there is usually established a quarter for the residence of foreigners, but the municipal government is Chinese. Such are Tsinan and Changsha.

In all the four classes mentioned the foreign resident is under the jurisdiction and protection of his own government, represented by the consul.

⁷⁵ Population, 28,600; whole trade of the district (3 ports) in 1917, Tls. 39,500,000.

The fifth class includes the open ports in territories that have been leased for a term of years to a foreign power. In these ports the lessee power exercises sovereignty during the continuance of the lease. At the same time the Chinese customs functions at the port and collects duties on all imports going from the free area into China and on all exports coming from China into the free area but pays a proportion of the revenues thus derived to the lessee power for municipal expenses. Kiaochow leased territory is of this sort, and Tsingtao is a port in that territory where such procedure obtains. In such ports there is no exercise by any consul of extraterritorial jurisdiction. He is accredited to the lessee power, and his nationals are amenable to its jurisdiction.

THE REMEDY FOR THE ANOMALOUS POLITICAL CONDITIONS IN CHINESE OPEN PORTS

The creation of open ports in China in the first instance was due to the Chinese desire to segregate the foreign residents so as to keep them under control. When the exercise of extraterritoriality was established by the treaties negotiated after the first war with Great Britain the limitation of foreign residence to certain ports was a natural corollary, for it would be extremely difficult for a consul to exercise jurisdiction over his nationals if they were allowed to live and transact business at will in any part of the vast territory of China. The recent wholesale opening of inland towns and villages in certain provinces is a striking departure from the earlier practice. It seems to betray on the part of the power concerned a deliberate intention to settle its subjects in all parts of these provinces. Apparently there is a desire to obtain political rather than commercial advantages. The methods employed by this power in the past show that it does not hesitate to avail itself of any pretext for interference with local authorities, even to the extent of attempting to exercise police jurisdiction over Chinese citizens outside of foreign settlements in direct violation of Chinese sovereignty.

The cure for this anomalous condition of affairs would seem to be the surrender by foreign powers of the right of extraterritoriality and the opening by China of the whole country to foreign residence. It is not practicable to do this immediately, but it is possible to accomplish it gradually. China has already revised her codes and is establishing modern courts as rapidly as men can be trained for the judiciary. It is worth considering whether it may not be wise for the foreign powers to hasten this process by some such method as is being employed in Siam, where certain powers have agreed to place their nationals under the jurisdiction of certain courts provided with foreign advisers and subsequently to place them under the jurisdiction of the ordinary courts, the latter to function just as soon as the required codes are promulgated.

THE PROBLEM OF MAYDA, AN ISLAND APPEARING ON MEDIEVAL MAPS

By WILLIAM H. BABCOCK

Of all the legendary islands and island names on the medieval maps, Mayda has been the most enduring. The shape of the island has generally approximated a crescent; its site most often has been far west of lower Brittany and more or less nearly southwest of Ireland; the spelling of the name sometimes has varied to Maida, Mayd, Mayde, Asmaida, or Asmayda. The island had other names also earlier and later and between times, but the identity is fairly clear. As a geographical item it is very persistent indeed. Humboldt about 1836 remarked that, out of eleven such islands which he might mention, only two, Mayda and Brazil Rock, maintain themselves on modern charts.¹ In a note he instances the world map of John Purdy of 1834. However, this was not the end; for a relief map published in Chicago and bearing a notice of copyright of 1906 exhibits Mayda. Possibly this is intended to have an educational and historic bearing; but it seems to be shown in simple credulity, a crowning instance of cartographic conservatism.

POSSIBLE ARABIC ORIGIN OF NAME

If Mayda may, therefore, be said to belong in a sense to the twentieth century, it is none the less very old, and the name has sometimes been ascribed to an Arabic origin. Not very long after their conquest of Spain the Moors certainly sailed the eastern Atlantic quite freely and may well have extended their voyages into its middle waters and indefinitely beyond. They named some islands of the Azores, as would appear from Edrisi's treatise and other productions; but these names did not adhere unless in free translation. The name Mayda was not one of those that have come down to us in their writings or on their maps, and its origin remains unexplained. It is unlike all the other names in the sea. Perhaps the Arabic impression is strengthened by the form Asmaidas, under which it appears (this is nearly or quite its first appearance) on the map of the New World in the 1513 edition of Ptolemy (Fig. 1).² But any possible significance vanishes from the prefixed syllable when we find the same map turning Gomera into Agomera, Madeira into Amadera, and Brazil into Obrassil. Evidently this map maker had a fancy for superfluous vowels as

¹ A. von Humboldt: *Examen critique de l'histoire de la géographie du Nouveau Continent et des progrès de l'astronomie nautique aux quinzième et seizième siècles*, 5 vols., Paris, 1836-39; reference in vol. 2, p. 163.

² Konrad Kretschmer: *Die Entdeckung Amerika's in ihrer Bedeutung für die Geschichte des Weltbildes*, 2 vols. (text and atlas), Berlin, 1892; atlas, Pl. 12, map 1.

with both Brittany and Ireland. The former relation is pictorially attested by three Breton ships. One of them is shown returning to the mouth of the Loire. A second has barely escaped from the neighborhood of the fateful island. A third is being drawn down stern foremost by a very aggressive decapod which drags overboard one of the crew; perhaps she has already shattered herself on the rocks, offering the opportunity of such capture in her disabled state. A dragon flies by with another seaman, apparently snatched from the submerging deck. Blurred and confused inscriptions in strange transitional Latin seem to warn us of the special dangers of navigation in this quarter; the staving of holes in ships, the tawny monsters, known to the Arabs, which rise from the depths, the dragons that come flying to devour. The words "Arabe" and "Arabour" are readily decipherable; so is "dragones." Perhaps there is no statement that Arabs have been to that island, for their peculiar experience may belong to some other quarter of the globe; but the verbal association is surely significant. The name Bentusla (Bentufla?) applied to this crescent island by Bianco in his map of 1448⁴ has sometimes been thought to have an Arabic origin; but one would not feel safe in citing this as absolute corroboration. The Breton character of the ships, however, may be gathered (as well as from their direction and behavior) from the barred ensigns which they carry, recalling the barred standard set up at Nantes of Brittany, in Dulcert's map of 1339,⁵ just as the *fleur-de-lis* is planted by him at Paris.

MAYDA AND THE ISLE OF MAN

We have, then, in this fourteenth-century island a direct recorded association with the Arabs, followed long after by what have been thought to be Arabic names. We have also a pictorial and cartographical connection with Brittany and also an indication of relations with Ireland. This last is fortified by its next and, except Mayda, its most lasting name.

The great Catalan map of 1375⁶ (Fig. 3) calls it Mam, which should doubtless be read as Man, for it was common to treat "m" and "n" as interchangeable, no less than "u" and "v" or "i" and "y." Thus Pareto's map of 1455⁷ turns the Latin "hanc" into "hame" and "Aragon" into "Aragom." On some of the early maps, e. g. that of Juan da Napoli (fif-

⁴ Theobald Fischer: *Sammlung mittelalterlicher Welt- und Seekarten italienischen Ursprungs*, 1 vol. of text and 17 portfolios containing photographs of maps, Venice, 1871-86; reference in Portfolio 11 (Facsimile della carta nautica di Andrea Bianco dell'anno 1448), Pl. 3. See also Kretschmer, *op. cit.*, ext. p. 184.

⁵ A. E. Nordenskiöld: *Periplus: An Essay on the Early History of Charts and Sailing Directions*, transl. by F. A. Bather, Stockholm, 1897, Pls. 8 and 9.

⁶ *Ibid.*, Pl. 11.

⁷ Kretschmer, *Entdeckung Amerika's, etc.*, atlas, Pl. 5. (A section of this map, showing the island of Mam in the upper right-hand corner (the name being partly cut off), is reproduced in the *Geogr. Rev.*, or February, 1920, Vol. 9, p. 120.—EDIT. NOTE.)

teenth century),⁸ the proper spelling "Man" is retained, just as it is retained and has been ever since early Celtic days, in the name of the home of "the little Manx nation" in the Irish Sea. That the same name should be carried farther afield and applied to a remote island of the Atlantic Ocean is quite in accordance with the natural course of things and the general experience of mankind. No doubt the name Man might be derived from other sources, but the chances are in this instance that the Irish people whose navigators found Brazil Island (or imagined it, if you please) did the same favor for the crescent-shaped "Man," quite overriding for a hundred years any preceding or competing titles.

Almost immediately there was some competition, for the Pinelli map of 1384⁹ calls it Jonzele (possibly to be read I Onzele, a word which has an Italian look but is of no certain derivation), reducing the delineation of the island to a mere shred, bringing Brazil close to it, and giving the pair a more northern and more inshore location. Another map of about the same period follows this lead, but there the divergence ended. Soleri of 1385¹⁰ reverted to the former representation; and about the opening of the fifteenth century the regular showing of the pair was established—Brazil and Man, circle and crescent, by those names and in approximately the locations and relative position first stated.

It is true that the crescent island is sometimes represented without any name, as though it were well enough known to make a name unnecessary. But during the fifteenth century, when it is called anything, with a bare exception or two, it is called Man. Its shape and general location are substantially those of the Catalan map of 1375 on the maps of Juan da Napoli; Giraldi, 1426;¹¹ Beccario, 1426¹² and 1435;¹³ Bianco, 1436¹⁴ and 1448; Benincasa, 1467¹⁵ and 1482;¹⁶ Roselli, 1468;¹⁷ the Weimar map,

⁸ Listed as No. 17 in Justin Winsor: *The Kohl Collection* (Now in the Library of Congress) of *Maps Relating to America*, Library of Congress, Washington, D. C., 1904, p. 27.

⁹ A. E. Nordenskiöld, *Periplus*, Pl. 15.

¹⁰ *Ibid.*, Pl. 18.

¹¹ Theobald Fischer, *Sammlung*, etc., Portfolio 8 (Facsimile del Portolano di Giacomo Giraldi di Venezia dell'anno 1426).

¹² A section of this map, hitherto unpublished, is shown in the *Geogr. Rev.*, Vol. 8, 1919, opposite p. 40. The map does not extend far enough north, however, to show the island under discussion. Cf. p. 43 of the same volume.

¹³ Gustavo Uzielli: *Mappamondi, carte nautiche e portolani del medioevo e dei secoli delle grandi scoperte marittime costruiti da italiani o trovati nelle biblioteche d'Italia*, Part II (pp. 280-390) of "Studi Bibliografici e Biografici sulla Storia della Geografia in Italia," published on the occasion of the Second International Geographical Congress, Paris, 1875, by the Società Geografica Italiana, Rome, 1875; reference on Pl. 8 (the second edition, Rome, 1882, does not contain the plates). (For a reproduction of a section see the *Geogr. Rev.* for February, 1920, Vol. 9, p. 116.—EDIT. NOTE.)

¹⁴ A. E. Nordenskiöld, *Periplus*, Pls. 20 and 21.

¹⁵ *Ibid.*, Pl. 33.

¹⁶ Kretschmer, *Entdeckung Amerika's*, etc., atlas, Pl. 4, map 1. A section is reproduced in the *Geogr. Rev.* for February, 1920, Vol. 9, p. 121, showing the island (unnamed) in the upper right-hand corner.

¹⁷ E. L. Stevenson: *Facsimiles of Portolan Charts Belonging to the Hispanic Society of America*, *Publs. of the Hispanic Soc. of Amer.* No. 104, New York, 1916, Pl. 2.

(probably) about 1481;¹⁸ Freducci, 1497;¹⁹ and others—arguing surely a robust and confident tradition.

RESUMPTION OF NAME "MAYDA"

On sixteenth-century maps this island is still generally presented, though lacking on those of Ruysch, 1508;²⁰ Coppo, 1528;²¹ and Ribero, 1529;²² but suddenly and almost completely the name Mayda in its various forms takes the place of Man, a substitution quite unaccounted for. There are hardly enough instances of survival of the older name to be worth mentioning. Was there some resuscitation of old records or charts, now

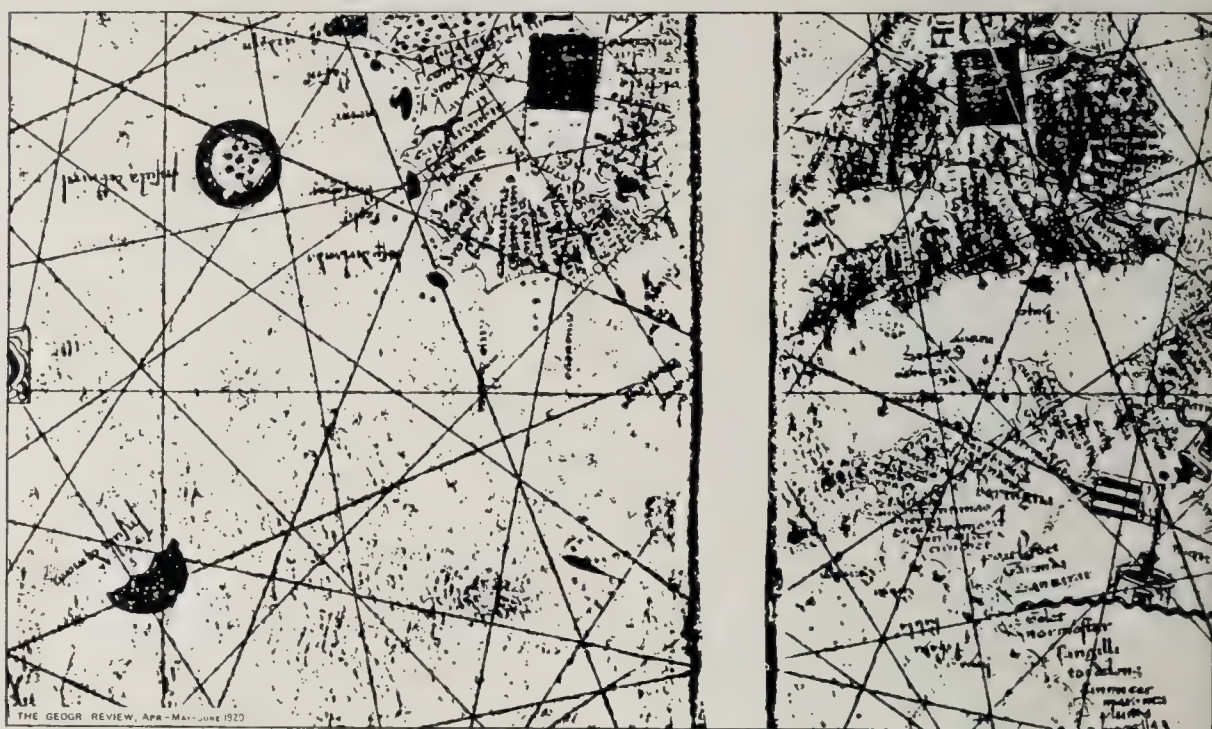


FIG. 3—Section of the Catalan map of 1375 showing the islands of Mayda ("Insula de Mam") and Brazil off the coast of Brittany and Ireland (inscriptions inverted). From Pl. 11 of Nordenskiöld's "Periplus", cited in footnote 5.

lost again, which thus overcame the Celtic claim and supplied an Arabic or at least a quite alien and unusual designation? The little mystery is not likely ever to be cleared up. The previously mentioned map from the Ptolemy edition of 1513, which perhaps first introduces it, also presents several other innovations in departing from the crescent form and shifting the island a degree or two southward; and these changes surely seem to hint at some fresh information. That there was no supposed change of identity

¹⁸ W. H. Babcock: *Indications of Visits of White Men to America before Columbus*, *Proc. 19th Internat. Congr. of Americanists, Held at Washington, Dec. 27-31, 1915* [Smithsonian Institution], Washington, D. C., 1917, pp. 469-478; map on p. 476.

¹⁹ A. E. Nordenskiöld, *Periplus*, Pl. 22.

²⁰ Kretschmer, *Entdeckung Amerika's, etc.*, atlas, Pl. 9, map 3; also in A. E. Nordenskiöld: *Facsimile Atlas to the Early History of Cartography*, Stockholm, 1889, Pl. 32.

²¹ Kretschmer, *Entdeckung Amerika's, etc.*, atlas, Pl. 14, map 5.

²² *Ibid.*, Pl. 15.

is shown by the fact that succeeding cartographers down to and beyond the middle of that century revert generally to the established crescent form and to nearly the same place in the ocean previously occupied by Man, while applying the new name Mayda. Thus an anonymous Portuguese map of 1519 or 1520,²³ reproduced by Kretschmer, and the graduated and

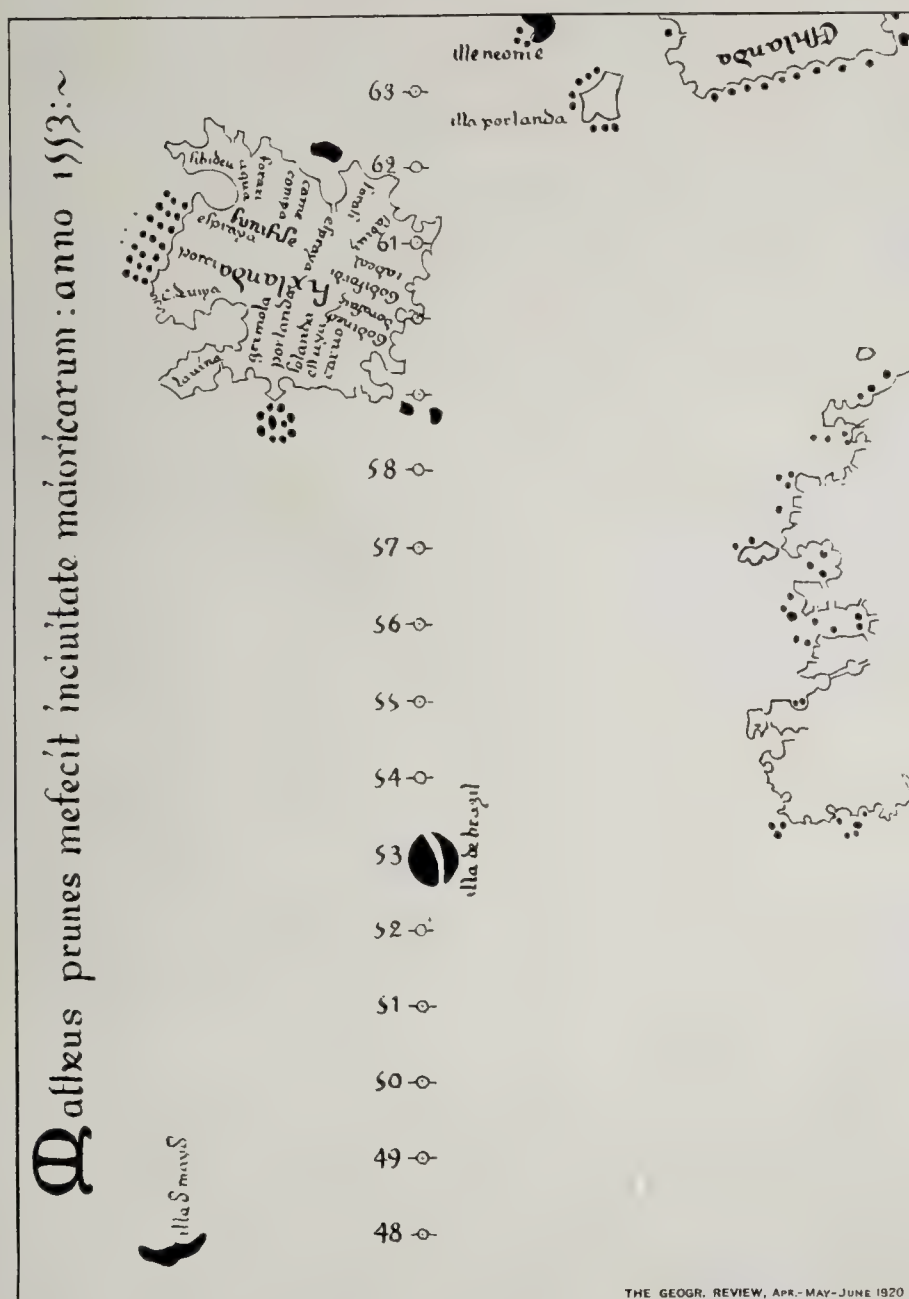


FIG. 4—The Prunes map of 1553 showing Mayda in latitude 48° N., southwest of Ireland. (From Pl. 4, map 5, of Kretschmer's atlas, cited in footnote 2.)

numbered map of Prunes, 1553 (Fig. 4),²⁴ concur in placing Mayda or Mayda
it about latitude 48° N., the latitude of Quimper, Brittany, and almost ex-
actly the same as that given by the Pizigani to the crescent island on its
first appearance on the maps as a clearly recognizable entity.

²³ *Ibid.*, Pl. 12, map 2.

²⁴ *Ibid.*, Pl. 4, map 5.

TRANSFERENCE OF MAYDA TO AMERICAN WATERS

The maps made after the world had become more or less familiarized with the details of modern discoveries, in this case as in most others of its kind, indicate little except the dying out of old traditions, whatever they may have been, and haphazard or conventional substitution of locations and forms or the influence of the new geographic facts and theories. Thus Desceliers' map of 1546,²⁵ a museum of strangely-named sea islands, makes the latitude of "Maidas" 47° and the longitude that of St. Michaels, but not long afterward Nicolay (1560;²⁶ Fig. 5) and Zaltieri (1566)²⁷ transferred the island to Newfoundland waters. Nicolay calls it "I man orbolunda," and places it just south of the Strait of Belle Isle. It is accompanied by Green Island and by Brazil, a little farther out on the Grand Banks where the Virgin Rocks may still be found at low tide. Taken together these three islands look like parts of a disintegrated Newfoundland. Zaltieri of 1566 gives Maida by that name more nearly the same outward location, though

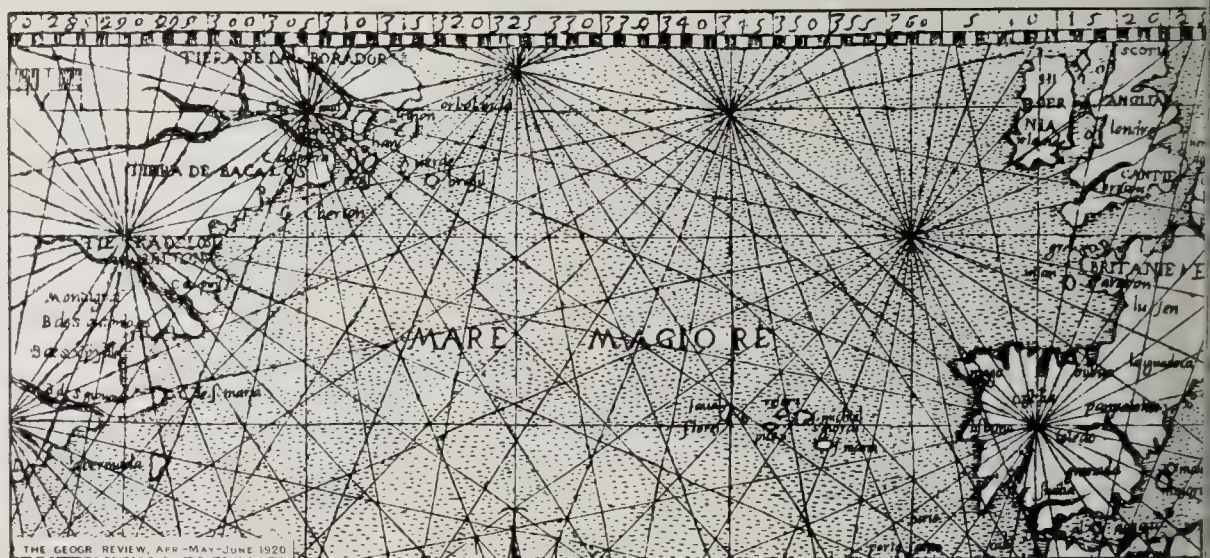


FIG. 5—Section of the Nicolay map of 1560 showing the islands of Mayda ("I man orbolunda") and Brazil transferred to the waters off the American coast. (From Pl. 27 of Nordenskiöld's "Periplus", cited in footnote 5.)

it is still distinctly American. Nicolay's name "orbolunda" is one of the many puzzling things connected with this island. His "Man" may be either a reversion to the fifteenth-century name, or, more likely, a modification of, or error in copying from Gastaldi's map-illustration²⁸ of Ramusius about ten years previously, which allots the same inclement site to an "isola de demoni" and depicts the little capering devils in wait there for their

²⁵ Kretschmer, *Entdeckung Amerika's*, atlas, Pl. 17; also A. E. Nordenskiöld, *Periplus*, Pl. 51.

²⁶ A. E. Nordenskiöld, *Periplus*, Pl. 27.

²⁷ Kretschmer, *Entdeckung Amerika's*, etc., atlas, Pl. 19, map 3.

²⁸ Justin Winsor: *Cartier to Frontenac: Geographical Discovery in the Interior of North America in its Historical Relations, 1534-1700, with Full Cartographical Illustrations from Contemporary Sources*. Boston and New York, 1894; reference on p. 60.

prey. It is likely, though, that Gastaldi had no thought of identifying it with Mayda. But the neighborhood of the island of Brazil and Green Island seem nearly conclusive evidence that Nicolay intended I Man for Mayda and had ascribed to it, by reason of evil association, the supposed attributes of Gastaldi's island. However, Ramusio himself in 1566,²⁹ the same year as Zaltieri, set his "Man" south of Brazil off the coast of Ireland. The only really important contributions of these maps are their testimony to the continued diabolical reports of Mayda, or Man, and the apparent conviction of Nicolay and Zaltieri that the island was after all American; a



FIG. 6—Section of the Ortelius map of 1570 showing the island of Vlaenderen in the customary location of Mayda off the coast of Brittany. The island of Brazil is unchanged in name and position from the earlier maps. (From Pl. 46 of Nordenskiöld's "Facsimile Atlas", cited in footnote 30.)

suggestion that could have had no meaning and no support in the times when America was unrecognized. Evidently these map makers did not regard the inadequate western longitude of Mayda, or Man, in the older maps as a formidable objection. Presumably they were well aware how many of the insular oceanic distances as shown by these forerunners needed stretching in the light of later discovery. But their views with regard to an American Mayda seem to have ended with them, so far as map representation is concerned.

²⁹ E. A. Nordenskiöld, *Periplus*, Fig. 76, p. 163.

POSSIBLE IDENTITY OF VLAENDEREN ISLAND WITH MAYDA

There is another curious and rather mystifying episodical divergence in the cartography of that period, this time on the part of the great geographers Ortelius and Mercator in their respective series of maps during the latter part of the sixteenth century, for example Ortelius of 1570³⁰ and Mercator of 1569 and 1587.³¹ Ortelius presents as Vlaenderen an oceanic island which certainly seems intended for Mayda (Fig. 6), while Mercator shows Vlaenderen as lying about half-way between Brazil and Maida. The word has a Dutch or Flemish look. Of course there must be some explanation of it, but this is unknown to the writer. The natural inference would be that some skipper of the Low Countries thought he had happened upon it and reported accordingly. This was what occurred in the case of Negra's Rock, now held to be wholly fictitious though shown in many maps; and also in the case of the sunken land of Buss, now generally recognized as real and as a part of Greenland but recorded and delineated in the wrong place by an error of observation. It may be that Ortelius believed in a rediscovery of Mayda and that for some reason it should have the name latest given. But in spite of the prestige of these great names, Vlaenderen did not continue on the maps, while Mayda did, though in a rather capricious way.

PERSISTENCE OF MAYDA ON MAPS DOWN TO THE MODERN PERIOD

There would be little profit in listing the maps of the seventeenth, eighteenth, and nineteenth centuries which persisted by inertia and convention in the nearly stereotyped delineation of Mayda but, of course, with slight variations in location and name. Thus F. De Witte in 1660 shows "As Maydas" in about the longitude of Madeira and the latitude of Brittany; a French map, unnamed, of 1771 gives "Maida" the longitude of Palma (Canary Islands) and the latitude of Gascony; and a chart of currents by Findlay, 1853, locates "Mayda" in the longitude of Iceland and the latitude of the mouth of the Loire. But these representations have no significance except as to human continuity.

The evil reputation which was early established and seems to have hung about the island in later stages, assimilating the icy clashings and noises and terrors of the north as it had previously incorporated the monstrous fears of a warmer part of the ocean, is surely a curious phenomenon. I have fancied it may be responsible for the probably quite imaginary Devil Rock, which appears in some relatively recent maps, perhaps as a kind of substitute for Mayda, much in the fashion that Brazil Rock took the place

³⁰ A. E. Nordenskiöld: *Facsimile Atlas to the Early History of Geography*, Stockholm, 1889, Pl. 46. A section of this map, showing Vlaenderen, is reproduced in Fig. 6.

³¹ A. E. Nordenskiöld, *Facsimile Atlas*, Pl. 47.

of Brazil Island when belief in the latter became difficult. The present view of the U. S. Hydrographic Office, as expressed on its charts, is that Negra's Rock, Devil Rock, Green Island, or Rock, and all that tribe are unreal "dangers," probably reported as the result of peculiar appearances of the water surface. Whether the possibility has been wholly eliminated of a lance of rock jutting up to the surface from great depths and not yet officially recognized, I will not presume to say; but it seems highly improbable that there is anything of the sort in the North Atlantic Ocean except the lonely and nearly submerged peak of Rockall, some 400 miles west of Britain, and the well-known oceanic groups and archipelagoes.

PROBABLE BASIS OF FACT UNDERLYING THIS LEGENDARY ISLAND

What was this island, then, which held its place in the maps during half a millennium and more, under two chief names and occasional substitutes, designations apparently received from so many different peoples? One cannot easily set it aside as a "peculiar appearance of the surface" or as a mere figment of fancy. But there is nothing westward or southward of the Azores except the Bermudas and the capes and coast islands of America. The identification with some outlying island of the Azores, as Corvo, for example, is an old hypothesis; and the grotesquery of that rocky islet seems to have deeply impressed the minds of early navigators, lending some countenance to the idea. But the Laurenziano map of 1351³² and the Book of the Spanish Friar³³ show that all the islands of the Azores group were known before the middle of the fourteenth century, and Corvo in particular had been given the name which it still holds. Man, afterward Mayda, appears on many maps of the fifteenth century which show also the Azores in full. Perhaps this is not conclusive, for there are strange blunders and duplications on old maps; but it is at least highly significant. If Man, or Mayda, were really Corvo or another island of the Azores group, surely someone would have found it out in the course of the fifteenth or sixteenth century, just as it came to be perceived after a time that the Azores had been located too near to Europe and just as Bianco's duplication of the Azores in 1448 had finally to be rejected. Mayda, if real, must have been something more remote and difficult to determine than Corvo.

Perhaps Nicolay and Zaltieri were right in thinking that Mayda was American, or at least was on the side of the Atlantic toward America. The latitude generally chosen by the maps would then call for Avalon Peninsula,

³² Theobald Fischer, *Sammlung*, etc., Portfolio 5 (Facsimile del Portolano Laurenziano-Gaddiano dell' anno 1351), Pl. 4.

³³ Book of the Knowledge of All the Kingdoms, Lands and Lordships That Are in the World, and the Arms and Devices of Each Land and Lordship, or of the Kings and Lords who Possess Them. Written by a Spanish Franciscan in the middle of the 14th century. Published for the first time with notes by Marcos Jiménez de la Espada in 1877. Translated and edited by Sir Clements Markham. *Hakluyt Soc. Publs.*, 2nd Ser., Vol. 29, London, 1912. Reference on p. 29.

Newfoundland, often supposed to be insular in early days; or perhaps for Cape Breton Island, the next salient land feature. But that is an uncertain reliance, for the observations of pre-Columbian navigators would surely be rather haphazard, and they might naturally judge by similarity of climate. This would justify them in supposing that a region really more southerly lay in the latitude of northern France—for example Cape Cod, which juts out conspicuously and is curved and almost insular. Or by going farther south, although nearer Europe, they might thus indicate the Bermudas, the main island of which is given a crescent form on several relatively late maps. But we must not lay too much stress on this last item, for divers other map islands were modeled on this plan. We may be justified, then, in saying that Mayda was probably west of the middle of the Atlantic and that Bermuda, Cape Cod, or Cape Breton is as likely a candidate for identification as we can name.

CLOUDINESS IN THE UNITED STATES*

By ROBERT DeC. WARD

Harvard University

EFFECT OF CLOUDINESS ON MAN

The amount of cloudiness affects man in many ways. In summer, cloudy days provide protection from the sun's rays. In winter, cloudy skies at night diminish nocturnal radiation, check the fall of temperature, and thereby reduce somewhat the need of fuel for heating purposes. Clear, calm winter nights are usually the coldest. On the other hand, dark overcast days in winter often seem colder than they really are because of their lack of sunshine. Such days necessitate an increased use of artificial light and hence of fuel for power purposes. The amount of cloud has distinct psychological effects. Continuously gray skies are depressing. Bright, sunny climates tend to make people cheerful. Steadily cloudless skies, on the other hand, easily become monotonous; the continued glare of the sun is tiring to the eyes, and one longs for clouds. The amount of cloud controls the duration of sunshine, the brightness of the sky, and the amount of diffused daylight. All these conditions have important relations to the distribution and growth of vegetation and to the development of micro-organisms. Medical climatology is closely concerned with cloudiness and sunshine in relation to health and disease.

The thickness and kind of cloud, as well as the amount, are important. There is a great difference between the effect, psychological as well as economic, of a thin sheet of high cloud, like cirro-stratus, and of a low, dark cloud layer of strato-cumulus or nimbus. A sky largely covered with fine-weather cumulus on a summer day makes a wholly different impression from that given by a stratus cloud sheet covering an equal portion of the sky.

CLOUDINESS AS A CLIMATIC ELEMENT

The amount of cloudiness is recorded by eye on a scale of 0 (cloudless) to 10 (overcast), and the conventional climatic summary includes the mean annual and mean monthly amounts of cloudiness, expressed in tenths or

* This is the fifth in a series of articles by the present writer on the climatology of the United States. The four previous articles were: Climatic Subdivisions of the United States, *Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, pp. 672-680; Rainfall Types of the United States, *Geogr. Rev.*, Vol. 4, 1917, pp. 131-144; Rainy Days and Rain Probability in the United States, *ibid.*, Vol. 7, 1919, pp. 44-48; Frost in the United States, *ibid.*, Vol. 7, 1919, pp. 339-344.

percentages. These means, while giving the larger facts which are quite sufficient in general climatic descriptions, do not furnish as vivid a picture of the nature and of the variations of cloudiness as is often desired in detailed studies of local climates. For such investigations, information regarding the average numbers of clear, partly cloudy, and cloudy days in each month should be included. This gives a more complete picture of the actual distribution of cloud and sunshine than do the monthly and annual means. It shows what kinds of days prevail throughout the year.¹ Further, if three observations of cloudiness are taken daily, it is very desirable to have the means for the morning, afternoon, and evening hours

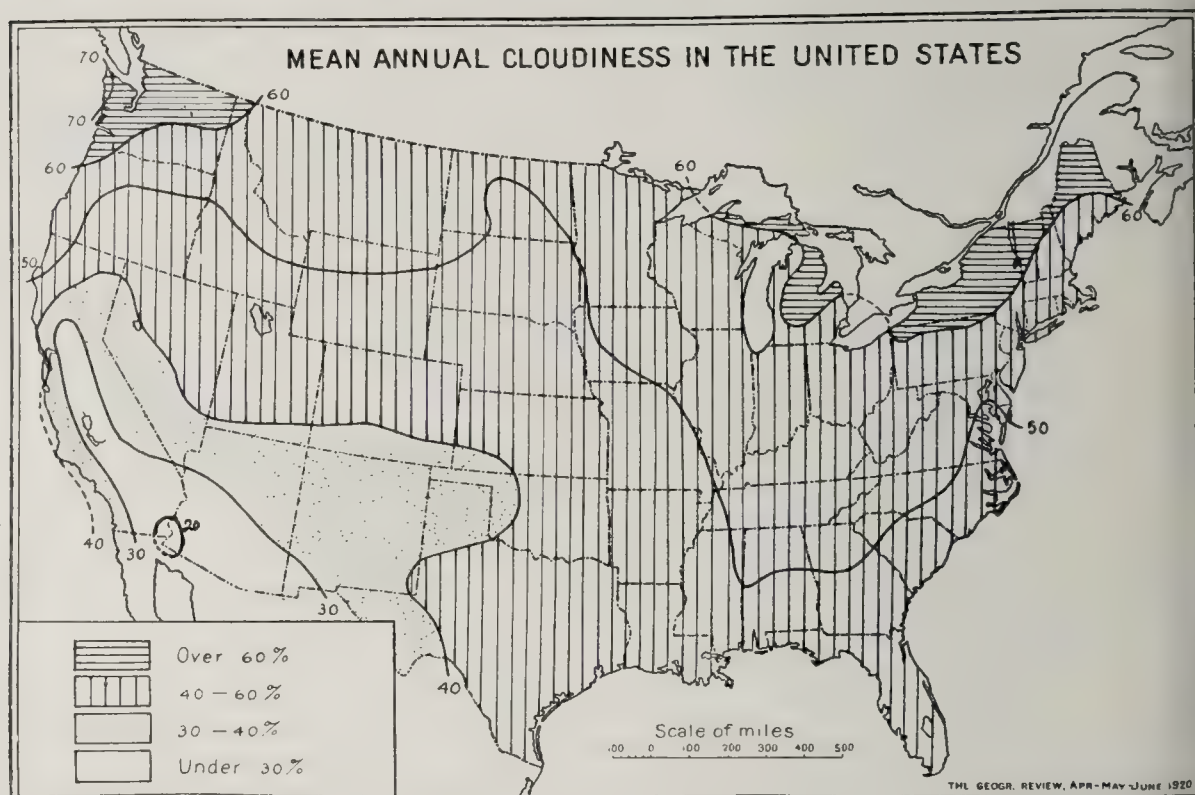
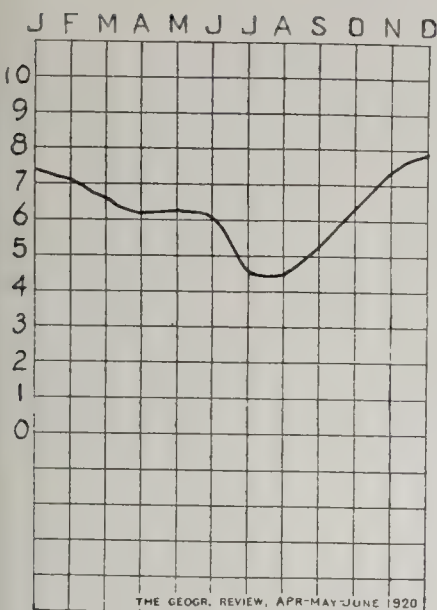


FIG. 1—Map showing mean annual cloudiness in the United States. Scale 1: 45,000,000.

given separately. In this way the diurnal variation of cloudiness can be readily seen. Two places may have exactly the same mean monthly cloudiness with quite a different diurnal distribution in the two cases. One of them, for example, may have prevailingly overcast skies in the mornings and evenings, with cloudless noon hours, while the other is partly cloudy all day. The economic and physiological effects of the two climates may differ greatly.

In a broad view of the climates of an extended area, like that of the United States, it is sufficient if the larger facts of annual and monthly

¹ Observations covering this aspect of cloudiness are regularly published by the U. S. Weather Bureau in the *Climatological Data* of the various sections, the *Monthly Weather Review*, and the *Annual Reports of the Chief of the Weather Bureau*.



amounts of cloud are known. Details may easily be looked up if they are desired.

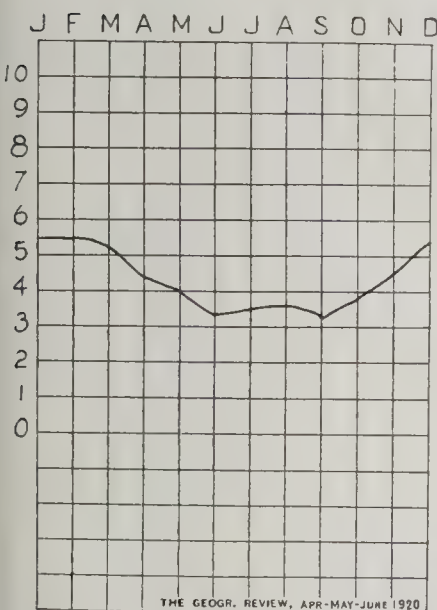
THE AVAILABLE CLOUDINESS MAPS OF THE UNITED STATES

The first monthly and annual cloudiness maps for the United States were included in Teisserenc de Bort's isonephs² for the world (1884) and were necessarily based on very incomplete data.³

The first complete set of monthly cloud maps for the United States alone was published by General A. W. Greely, then Chief Signal Officer, in 1891.⁴

The first map of mean annual cloudiness for the United States alone was that published in the *Annual Report of the Chief of the Weather Bureau for 1896-97*.⁵

A new series of maps, both monthly and annual, appeared in 1911. These were constructed by Kenneth McR. Clark, then a



FIGS 2-17—Diagrams showing, month by month, the annual variation of cloudiness in the different climatic provinces of the United States.

FIG. 2—North Pacific coast (annual mean, 6.3).

FIG. 3—Middle Pacific coast (annual mean, 4.4).

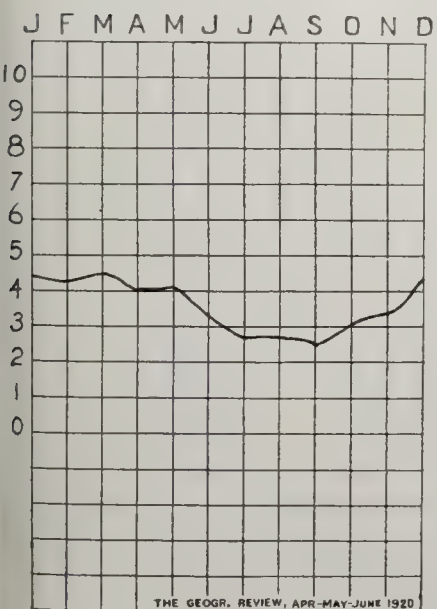
FIG. 4—South Pacific coast (annual mean, 3.6).

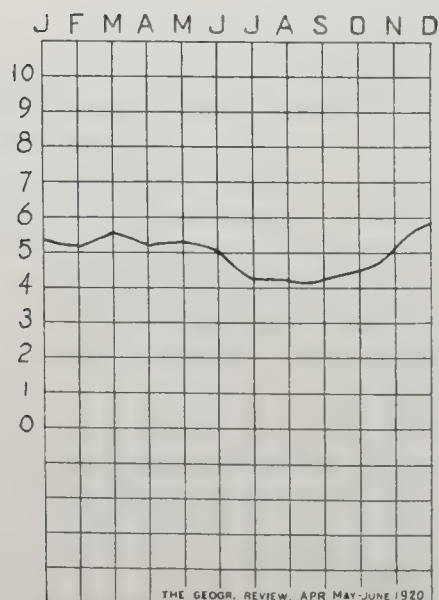
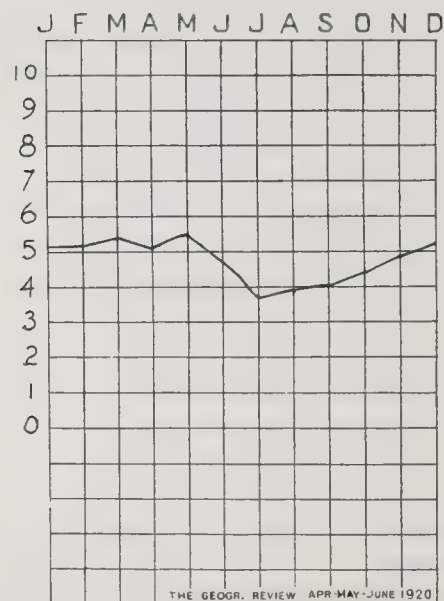
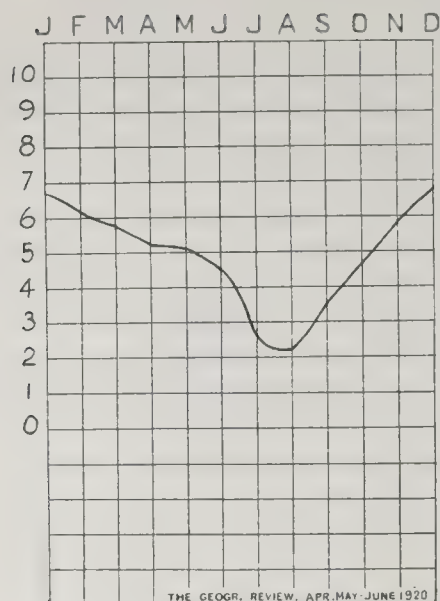
² Lines of equal cloudiness.

³ Léon Teisserenc de Bort: *Etude sur la distribution moyenne de la nébulosité à la surface du globe d'après les premières cartes d'isonephes*, *Annales Bur. Central. Météorol. de France*, Vol. 4, 1884. The data for the United States were those for 96 stations. for the period 1843-1854, originally published in the *Army Meteorological Register*. These maps are reproduced, in colors, in the "Atlas of Meteorology," 1899, Pls. 17 and 18, text, p. 16, the annual map for the United States having been revised by the incorporation of more recent data included in the *Annual Report of the Chief of the Weather Bureau for 1896-97*.

⁴ A. W. Greely: *Charts Showing the Average Monthly Cloudiness for the United States*, folio, U. S. Signal Service, Washington, D. C., 1891. These maps were based on recent data collected by the Signal Service. The longest period covered by the observations was 18 years (1871-1888), and many of the 143 stations had shorter records. A discussion of the facts brought out on General Greely's maps was later published by Köppen (W. Köppen: *Regenwahrscheinlichkeit und Bewölkung in den Vereinigten Staaten von Nordamerika*, *Meteorol. Zeitschr.*, Vol. 10, 1893, pp. 161-168), who also constructed a series of diagrams showing the annual variation of cloudiness for latitudes 32°, 40°, and 47° N., for longitudes 87° and 97° W., and for the Atlantic and Pacific coasts.

⁵ Part VI, Chart XX, text, pp. 286-287, Washington, D. C., 1893





student in Harvard University.⁶

In 1912 another and still more complete set of maps and diagrams, prepared by Gläser, was published.⁷ There are thus already available two recent sets of monthly and annual cloud maps, those of Clark and of Gläser. The latter are based on somewhat more complete data than the former, and the isonephs are drawn with more attention to details. In their broad general features the two sets of maps are essentially similar. Neither series is fully up to date, but it is unlikely that the addition of newer data would lead to any important modifications in the locations of the monthly isonephs already drawn.⁸

THE PRESENT CLOUDINESS MAP OF THE UNITED STATES

The accompanying new map of mean annual cloudiness (Fig. 1), here published for

FIG. 5—Northern Plateau Province (annual mean, 5.0)

FIG. 6—Northwestern Plains Province (annual mean, 4.8)

FIG. 7—Upper Mississippi Valley (annual mean, 5.0).

⁶ K. McR. Clark: A New Set of Cloudiness Charts for the United States, *Quart. Journ. Royal Meteorol. Soc.*, Vol. 37, 1911, pp. 169-175. Observations were used from 77 stations with records for 30 or more years; 31 with less than 10 years, and 15 with 5 years or less. The isonephs were intentionally generalized so as to bring out only the larger facts.

⁷ Arthur Gläser: Bewölkungsverhältnisse und Sonnenscheindauer von Nordamerika, *Aus dem Archiv der Deutschen Seewarte* (Hamburg), Vol. 35, 1912, No. 1, pp. 1-63. This is the most complete discussion of the cloudiness and sunshine of the United States up to the present time. General Greely's maps have been revised by the inclusion of newer and more complete data covering the year 1906, 236 stations in all being used. There are maps showing annual, seasonal, and monthly isonephs; the annual range in cloudiness; seasons of maximum and of minimum cloudiness; and isopleths for latitudes 32°, 40°, and 47° N., for longitudes 80°, 90°, 100°, and 110° W., and for the Atlantic and Pacific coasts.

⁸ For further brief discussions of cloudiness in the United States see: A.W. Greely: *American Weather*, New York, 1888, pp. 64-68 (gives maps of mean cloudiness for January and August on the basis of observations for 1871-86; also curves showing the annual fluctuations of cloudiness at selected stations); Frank Waldo: *Elementary Meteorology*, New York, 1896, pp. 352-354 (reproduces General Greely's maps for January and August); Julius von Hann: *Handbuch der Klimatologie*, 3d edit., Stuttgart, 1911, Vol. 3, pp. 390-391; F. L. Wachenheim: *Die Hydro-meteore des gemässigten Nordamerika*, *Meteorol. Zeitschr.*, Vol. 22, 1905, pp. 193-211 (with monthly percentages for selected districts).

the first time, was drawn by the present writer on the basis of the latest and most complete data now available. These data were supplied by the courtesy of the Weather Bureau. They include all the regular Weather Bureau stations having a length of record sufficient to justify the preparation of the mean values. The total number of stations employed was about 190. Of these, 65 had over forty years of observations; nearly 40 had between thirty and forty years; 30 had from twenty to thirty years; 40 from ten to twenty; and the remainder ten years or less. The last year included in the means was 1918. In drawing the isonephs somewhat greater weight was laid on the data for stations with

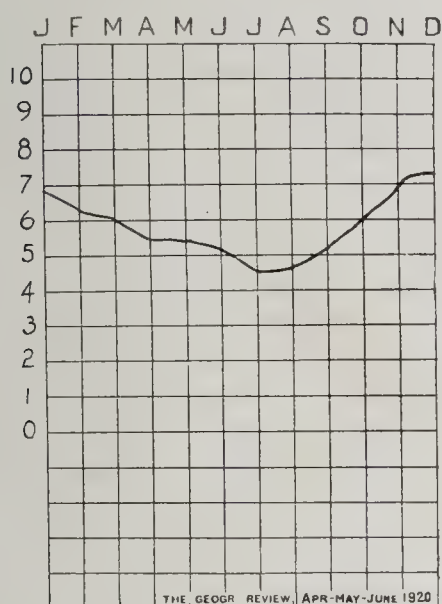


FIG. 8—Upper Great Lakes (annual mean, 5.8).

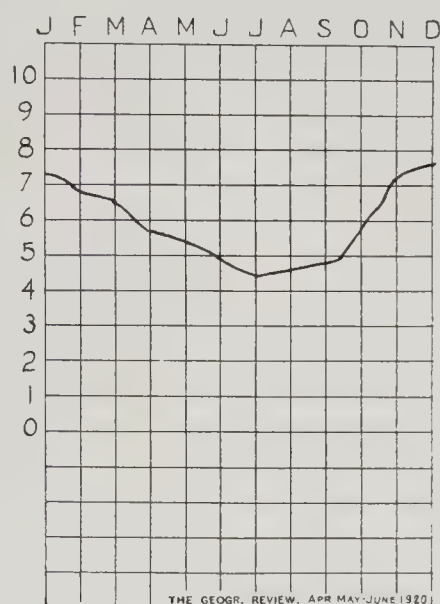


FIG. 9—Lower Great Lakes (annual mean, 6.0).

the longer periods of observations. In dealing with the element of cloudiness, however, the amounts of which are estimated by eye, perfect accuracy is obviously impossible of attainment. It appears on investigation that short-period means do not depart to any considerable degree from long-period means. Indeed, the departures are probably no greater than the differences resulting from the personal equation in the case of different observers. It is, therefore, unnecessary to reduce the means of cloudiness to the same period of time, as is done in the case of instrumental records. Furthermore, the short-period records are by no means to be disregarded as altogether unreliable. The accompanying map is intentionally generalized. It is designed to present the larger facts in the distribution of the mean annual cloudiness and not to emphasize details. The isonephs were first drawn on a large-scale map with careful attention to the actual data. They were then transferred to a small-scale map and smoothed. In several cases in which a single station shows a slightly greater or smaller amount of cloudiness than the surrounding sections, that station was deliberately

omitted in order not to overemphasize local conditions.⁹ In drawing isonephs for as large an area as that of the United States, with the relatively small number of stations for which records are available, a good deal must be left to the individual judgment of the investigator and to his desire to present either a more detailed, or a more broadly generalized, picture.

MEAN ANNUAL CLOUDINESS

If details are omitted and only the larger facts are kept in view, the general distribution of cloudiness for the year is easily described and

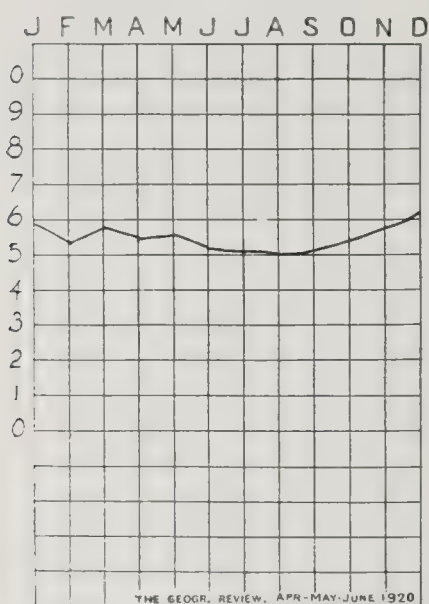


FIG. 10—New England (annual mean, 5.5).

remembered. There are two districts of maximum cloudiness (over 60 per cent): one lying over most of the Great Lakes region and extending northeastward over the St. Lawrence valley and northern New England, the other found on the extreme northwestern Pacific coast. Both of these sections are under marked cyclonic control, especially in the colder months. In both cases the prevailing winds in general blow across bodies of water. On the Pacific slope the presence of mountains close to the coast is an additional factor in causing condensation. It is significant that in this last-named section the areas of maximum cloudiness and of maximum rainfall correspond closely. The southwestern portion of the Plateau Province¹⁰ (between the Rocky

Mountains and the Sierra Nevada) is the least cloudy section of the country. Southern Arizona and the central and southeastern parts of California have less than 30 per cent. A smaller area centered around Yuma, Ariz., has less than 20 per cent. The sunny skies of the Southwest are easily explained. Few general storms frequent that part of the country, and it is well shut off from moisture-bearing winds. In going eastward from the Southern California coast into the desert there is a marked and rapid decrease in cloudiness.

In general, the eastern half of the country has more, and the western half, except on the North Pacific coast, less than 50 per cent. The

⁹ For example, in the Appalachian area, in an extended region having as a whole between 50 and 60 per cent, Elkins, W. Va., with a 20-year record, has 63 per cent; Wytheville, Va. (16 years), has 46 per cent; Reading, Pa. (6 years), has 60 per cent; Harrisburg, Pa. (30 years), has 56 per cent. Walla Walla, Wash. (31 years), has 50 per cent, and Havre, Mo. Dak. (36 years), has 49 per cent in a general area having between 50 and 60 per cent. Green Bay, Wis. (32 years), has 64 per cent in a general area with 50 to 60 per cent. There are a few other cases which have similarly been omitted.

¹⁰ One of the climatic provinces into which the author has divided the United States. See R. DeC. Ward: *Climatic Subdivisions of the United States*, *Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, pp. 672-680, especially map on p. 678.—EDIT. NOTE.

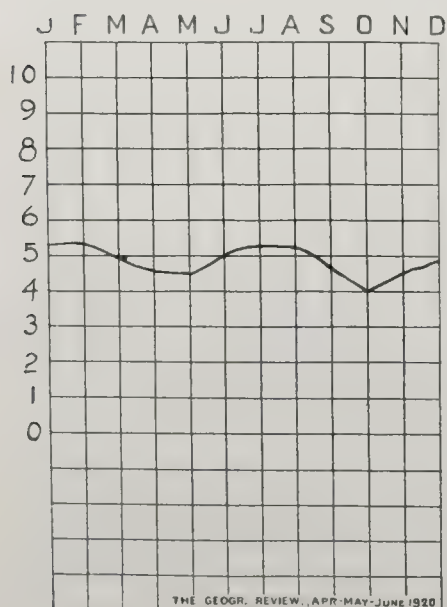
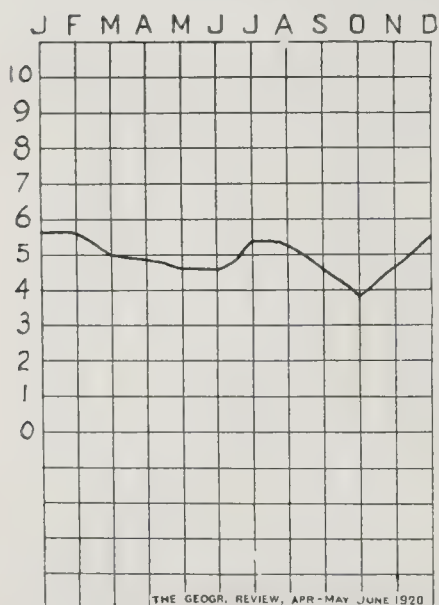
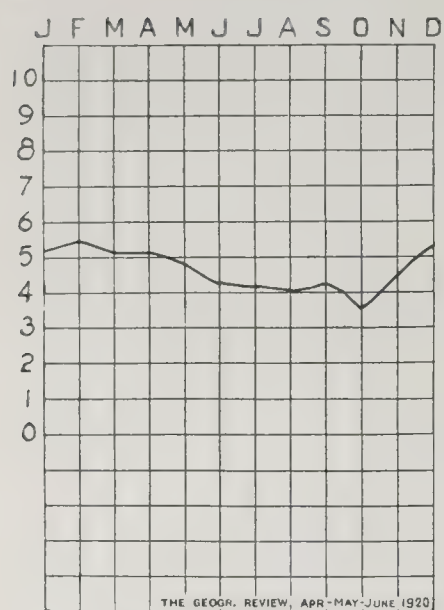
Northern States are more cloudy than the Southern, as is to be expected from the more active and more frequent storm control in the north. This difference is well marked on the Pacific coast and over the plateau; it is less so in the East. The Pacific coast as a whole is less cloudy than the Atlantic, but the northern part of the Pacific coast is more cloudy than any portion of the Atlantic. Over thirty years ago Woeikof called attention to the fact that, although the available data on cloudiness for the eastern United States were then scattering and unsatisfactory, it was already certain that the mean annual cloudiness is less here than in Europe, excepting in the Mediterranean area.¹¹

SEASONAL VARIATIONS IN CLOUDINESS

The mean annual amount of cloudiness, the distribution of which has just been considered, is the result of the interaction of all the cloud-producing conditions working together throughout the year. As these conditions vary more or less in the different months, the average percentage of cloudiness for the whole year gives a very inadequate, and not infrequently quite a misleading, impression of the state of the sky as this is actually seen from day to day and from month to month. If the monthly maps of isonephs are examined, a general but somewhat irregular seasonal migration of the lines of equal cloudiness becomes apparent. Taking the country as a whole, winter is the cloudiest and summer the clearest season. Roughly, from midsummer to early winter there is an equatorward movement of the belt of maximum cloudiness, and from midwinter to summer there is a general northward retreat. This seasonal movement of the isonephs is associated with the corresponding equatorward and poleward migration of the general storm belt, and the latter, in turn, depends upon the seasonal changes of temperature. In winter general storms are more frequent, better developed, and affect larger sections of the country. This involves the development of more frequent and more extended cloud sheets. Furthermore, during the colder months, winds which blow from warm waters naturally tend to become cloudy and rainy as they pass over the colder land to leeward. During the winter the Great Lakes and the North Pacific coast have a mean monthly cloudiness of more than 70 per cent and even of more than 80 per cent over smaller areas. The lee shores of the Great Lakes are more cloudy than those to windward. In summer, these same sections (Great Lakes and North Pacific coast) have, in general, about 50 per cent or less. An exception is a narrow strip on the coast of Washington, which even in summer maintains a mean cloudiness of over 60 per cent.

In the Southwest, the area of minimum cloudiness shows a gradual expansion northward and eastward as the season advances. The 30 per

¹¹ Alexander Woeikof: *Die Klimate der Erde*, 2 vols., Jena, 1887; reference in Vol. 2, p. 45.



cent isoneph, which encloses a relatively small area in the extreme southwestern interior in winter, covers most of the interior Plateau Province by midsummer, when the 20 per cent and 10 per cent lines, which do not appear at all on the winter maps, enclose considerable portions of that same district.

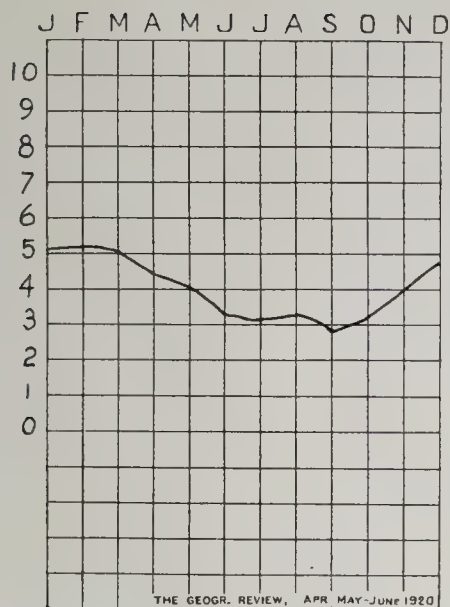
There are certain exceptions to the general rule, above stated, that the winter is the cloudiest and the summer the clearest season. The Pacific coast distinctly shows the contrast between the cloudier skies of its winter and the summer skies of its summer and early fall. Figures 2, 3, and 4 show the characteristic seasonal distribution of cloudiness on the Pacific coast and also the gradual decrease in the amount of cloud from north to south. There the season of rain and the season of maximum cloudiness go closely hand in hand.¹² In the Valley of California the midsummer months are indeed almost cloudless as well as rainless, thus providing most favorable conditions for many outdoor occupations such, for example, as the sun-drying of raisins. Over the northern tier of states as a whole, from the Pacific to the Atlantic, July and August (or September) are the least cloudy months. Figures 5 to 9 illustrate the annual variation of cloudiness over the northern tier of states from the northern Plateau Province eastward to the lower Great Lakes. New England (Fig. 10) has very little variation in cloudiness through the year. The southern tier of states, on the other hand, with a few exceptions, has its minimum cloudiness in autumn, October being quite generally the least cloudy month (Figs. 11-13). These autumn months are a transition season, before

FIG. 11—West Gulf States (annual mean, 4.7).

FIG. 12—East Gulf States (annual mean, 5.0).

FIG. 13—South Atlantic States (annual mean, 4.8).

¹² In these and the following figures the curve showing the annual variation of cloudiness is based on the mean monthly cloudiness as determined by combining the data for a group of stations in that particular section. The curves are therefore composites.



the winter storm control sets in, and are also a time of minimum rainfall over a considerable portion of the eastern United States.

The winter (December-February) maximum of cloudiness is characteristic of the Pacific slope (Figs. 2-4), the Plateau (Figs. 5 and 14), and all of the southern and eastern United States excepting Florida. The northernmost tier of states east of the Great Plains, including most of the upper Great Lakes region and New England, has its maximum in late autumn or early winter (Figs. 8-10). Middle or late spring is the cloudiest season over the northern Great Plains, when the rainfall maximum of that section is already well marked (Figs. 6 and 15), while the middle and late summer convectional rains of the southern Plateau, with prevailing southerly winds, give a maximum, or at least a secondary maximum, there in July and August (Fig. 16). In Florida, also, the summer months with their heavy rainfalls are the cloudiest season (Fig. 17).

ANNUAL VARIATION IN CLOUDINESS

Over most of the country the difference between the amount of cloud in the cloudiest and in the least cloudy months is so small (generally 10-20 per cent) as to be of no special significance. In the two districts of maximum annual cloudiness, the Great Lakes and the North Pacific coast, there is a greater difference (30 per cent or more) between the percentages of cloudiness at the times of maximum and minimum. The western Plateau also has a marked contrast (30-40 per cent and over) between its cloudy and its clear seasons. The summers are there very sunny, while the winter storms, passing over this district from the Pacific, cause a fair amount of cloudiness. Woeikof seems to have been the

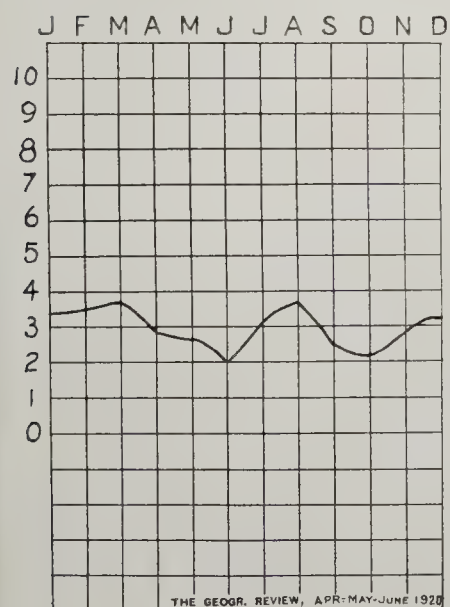
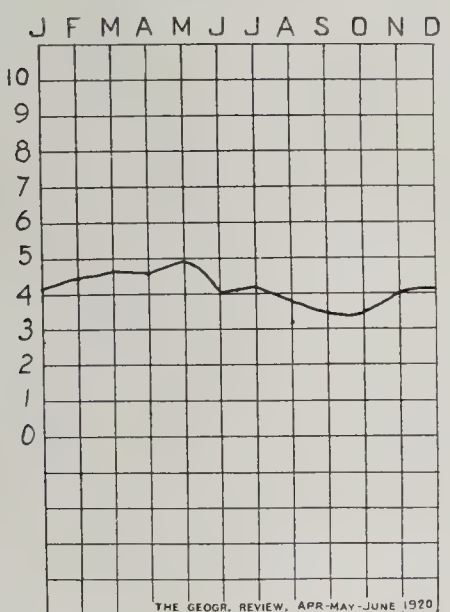


FIG. 14—Middle Plateau Province (annual mean, 4.0).

FIG. 15—Central Plains Province (annual mean, 4.1).

FIG. 16—Southern Plateau Province (annual mean, 3.0).

first to point out that the annual variation in cloudiness in the central and eastern portions of the United States is less than that in Europe;¹³ and von Hann has called attention to the fact that there is no such well-marked annual variation in the eastern United States as there is in eastern Asia.¹⁴ The reason is found in the frequency of damp, easterly cyclonic winds during the American winters, while in eastern Asia the dry offshore northwesterly winds are the dominant winter characteristic and give clear skies.

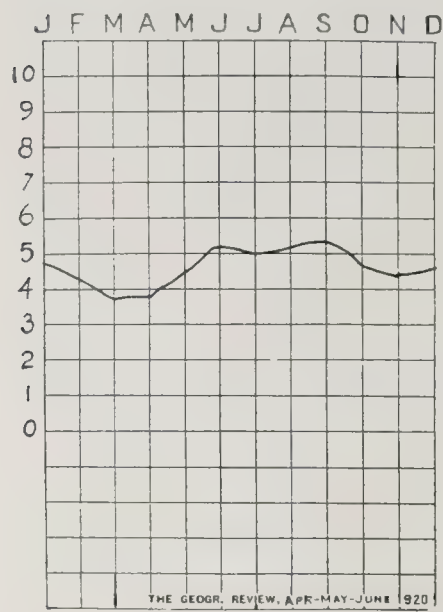


FIG. 17—Florida Peninsula (annual mean, 4.6).

RELATION OF CLOUDINESS TO RAINFALL

Another matter which also deserves mention here was emphasized by General Greely in his discussion of his monthly cloudiness maps.¹⁵ The annual amounts of rainfall and of cloudiness show no fairly fixed ratio, as might at first thought be expected. In comparing the southern Great Plains and their relatively small amount of cloud with the cloudier and rainier Great Lakes region, cloudiness and rainfall may seem somewhat closely related. In going east from the northern Great Plains to the Great Lakes, on the other hand, the rainfall doubles while there is no correspondingly marked increase in the amount of cloud; and the northern Gulf Province

has about four times the rainfall of New Mexico, while the cloudiness in the former district is not even double that in the latter.

¹³ Woeikof, *loc. cit.*
¹⁴ Julius von Hann, *loc. cit.*
¹⁵ A. W. Greely, work cited in footnote 4.

GEOGRAPHICAL RECORD

AMERICAN GEOGRAPHICAL SOCIETY

Meetings of April. The last meetings of the American Geographical Society for the season of 1919-20 were held on April 6 and April 20 at the Engineering Societies' Building, 29 West Thirty-ninth Street. At both meetings President Greenough presided. At the semi-monthly meeting on April 6 the Charles P. Daly Medal of the Society was presented to Dr. George Otis Smith, director of the U. S. Geological Survey. An account of the presentation, and of Dr. Smith's address on "The Geographic Side of Geology" which followed, is given immediately below. On April 20 a monthly meeting was held, at which President Greenough submitted the names of 14 candidates for Fellowship, each of whom had been approved by the Council, and they were confirmed as Fellows of the Society. Thereupon Dr. Edgar J. Banks, late field director of the Babylonian expedition of the University of Chicago, delivered an address entitled "A Thousand Miles Down the Tigris River."

Presentation of the Charles P. Daly Medal to Dr. George Otis Smith. At the semi-monthly meeting of the American Geographical Society on April 6, at the Engineering Societies' Building, 29 West Thirty-ninth Street, the Charles P. Daly Medal of the Society was presented to Dr. George Otis Smith, director of the U. S. Geological Survey. In presenting the medal, President Greenough, who presided at the meeting, spoke as follows:

"The foundation of the medal, which as your President I am about to present, prescribes that it shall be bestowed for contribution to geographical science, and it is most suitably awarded to our guest in the present instance. The fervent political atmosphere which surrounds the executive offices of our Washington Government tends to obscure from the general public the valuable and original scientific work which is constantly performed by various auxiliary departments whose function, roughly speaking, is the acquisition of knowledge pertaining to the conditions and needs of the people of the United States and its adaptation to their use in practical affairs. Amongst the chief of these important agencies is the bureau known for forty years as the U. S. Geological Survey, of which our guest has been for many years the administrative head under the title of Director.

"The official designation of the bureau gives a very inadequate impression of the character and extent of the service rendered by it to the nation in its conception of its duties, which are defined as the 'examination of the geological structure, mineral resources, and products of the national domain.' It is not easy to grasp the magnitude of such an undertaking as applied to an area so great and varied as the United States, covering more than 3,000,000 square miles of territory. It involves the topographical survey and mapping of the field, the ascertainment in detail of quantity and character of minerals and other geological deposits, the ascertainment of water supply and power, the publication and adaptation of its investigations for use by the departments of the government and by the public, besides statistical compilations and research in many directions too numerous to enumerate here. My desire is only to outline the extent and value of the contribution thus made to scientific knowledge.

"But I may especially record the patriotic and vital part taken by the Survey in the prosecution of the war. Its honor roll numbers 477, and the work of its geologists, its topographers, its hydraulic engineers, and its statisticians found opportunity for invaluable aid to the armies at the front in the various spheres indicated by those titles, which services were acknowledged by citation and decorations by the French authorities as well as our own.

"The organization and control of the vast and complex mechanism which I have attempted to indicate devolved primarily upon its Director, who is justly entitled to the first place in the allocation of honor for its achievement. But he would be the readiest to disclaim an exclusive right to credit for results attained by the concerted action of his associates, and I may be permitted to join with his name a public recognition of the work done by Lieutenant-Colonel A. H. Brooks, Lieutenant-Colonel R. B. Marshall, Lieutenant-Colonel Birdseye, Lieutenant-Colonel Glenn Smith, Major J. W. Bagley, Dr. J. B. Umpleby, and Dr. E. S. Bastin in the organization of departments

of work of special importance to the nation, at home and in France, in addition to Major L. L. Lee, Major J. H. Wheat, Captain A. T. Fowler, and Lieutenant Mudd, and many others, including topographers and geologists who rendered distinguished service in the field.

"With the cessation of the war the Survey was amongst the first to readjust itself fully to the discharge of its useful function in time of peace. The enormous accession to the industrial development of our country will make increased demand upon its facilities, and the nation will regard with confidence and pride the conduct of this great bureau under the management of its accomplished Director.

"And now, Sir, on behalf of the Society I ask your acceptance of this medal, which is inscribed as follows:

TO
GEORGE OTIS SMITH
DIRECTOR OF THE UNITED STATES GEOLOGICAL SURVEY
HE HELPED DISCLOSE AND DEVELOP THE
NATURAL RESOURCES OF HIS COUNTRY
ADAPTING THEM TO ITS SERVICE IN PEACE AND WAR
1920

"Upon this record of distinguished effort and successful achievement—the aim of all human endeavor—I beg to offer the congratulations of the Society and its earnest good wishes for your future health and prosperity."

In accepting the medal, Dr. Smith spoke as follows:

"Recognition of service rendered is always acceptable. Especially am I pleased, President Greenough, that by your mention of my associates you have called attention to the fact that the best public service is truly democratic. The work of a great Federal bureau is not only for the many, it is by the many. Representing here the U. S. Geological Survey, I feel that the honor your society has accorded me is the greater because it has been won by united effort.

"The service flag that hangs behind my desk at Washington is a reminder of the 477 men who wore the uniform of the Army or Navy and whom you just now mentioned as constituting the Survey's roll of honor; and we are proud, too, of the score of citations and decorations won overseas by these technically trained officers, including three French crosses for exceptional bravery at the front. But, Sir, there were hundreds of other members of the U. S. Geological Survey who rendered equally needed service in their civilian capacity; indeed there were scores of our best men who preferred overseas service but were commandeered for office or field work as civilians here in the United States. That type of sacrifice also helped win the war.

"It is, Mr. President, in behalf of all these, my associates, that I express my deep appreciation of this honor, and in accepting the Charles P. Daly Medal of the American Geographical Society I assure you that the work for which the award is made is still in progress. I trust, moreover, that our contributions to geographic science may increase in scope and value in the years to follow. And so I thank you, Sir, for this added incentive to future service."

DR. SMITH'S ADDRESS

There followed an address by Dr. Smith entitled "The Geographic Side of Geology", which is abstracted as follows:

The distinction between the two sciences of geology and geography, which have so much in common as regards scope, method, and personnel, can perhaps be best expressed in terms of their space relations. Geography in this sense is a two-dimensional science; geology adds the third dimension, for it looks beneath the surface of the earth, and its attention to the past and its regard for the future might justify a claim to a fourth dimension—time. It follows that geography becomes the limiting upper plane, along which most men find their only contact with geology, while the fourth, or time, dimension of geology transcends the length and breadth of this plane. This illustration may serve to exhibit the phase of geology which I wish to discuss, its geographic side.

Since the period of Government surveys terminated by the Civil War, the trend of geology has been decidedly toward the practical. The work of the U. S. Geological Survey, with the attention given by its field service to the search for water, ore, coal, and oil, has brought the science into closer touch with the industrial life of the people. The emphasis has been put on resources and use, and the phase of the science which has been most developed under both governmental and educational auspices is economic geology.

The distribution of mineral resources stands out as the geographic phase of applied geology and leads directly to questions of utilization. The value of ores is determined in part by locality and is dependent upon facts of transportation. Thus, in the inventory of mineral resources necessitated by the outbreak of the war, the emphasis was immediately put upon the geographic facts of locality and accessibility, while economy of transportation became the test of value in the examination of ore deposits.

The study of national resources for use in the war program led also to the development of the international view of mineral resources and the industry and commerce founded upon them, and a specialized type of geology, its application in terms of commerce, was demanded. The worker in this field needs to interpret his facts of ore occurrence in terms of use and value to mankind. Ore deposits thus take on competitive relations, which depend in turn upon geographic facts of distribution—not only the location of the ore, but its distance from the supplies of fuel, power, and labor required, as well as the available markets. The scientist must thus relate the facts of his science to national life, and it is this human application of geology which is also its geographic side.

Under the stimulus of the war demand, the work of the Survey in commercial geology took form in the preparation of a world atlas. In order to make the collected data useful to the citizens of the United States, this atlas is now being prepared for publication. The "Atlas of Commercial Geology" will exhibit graphically the distribution of mineral production and mineral reserves, and the necessary world view will be supplied by mineral maps of every continent, while the basal facts of commercial geology and their application to the problems of industry will be presented in a form available for use by the business man. In this connection, also, there has been established in the Survey an "open file" of mineral information for use by geologists and engineers. The first part of the atlas presents the distribution of mineral output in 1913 and is a record of the past, though the figures for that normal year express in a rough way the relative wealth of the leading nations in the essential minerals. The chief importance of the atlas, however, will be found in those parts which show the mineral reserves, though even here our knowledge must be subject to discount in view of the changes in transportation facilities, degree of industrial development, and market requirements, all of which are vital factors in the estimate of the value of mineral reserves.

A comparison of the continents as sources of mineral commodities in 1913 clearly demonstrates the dominance of Europe and America, and, if this comparison is expressed in terms of market value, America's industrial leadership becomes apparent. However, if we would add guarantees of permanence to present prosperity, American industry, in meeting the worldwide competition of the future, must benefit from the lessons learned during the war. There must be a full understanding of America's industrial dependence upon mineral resources, together with a regard for adequacy and permanence of supply, no less than for cost, while the war-time standard of utility as the measure of the value of mineral commodities should be retained. We must realize that resources are expendible, while industry is long-lived, and that commerce on a right basis is the equalizer of supply and demand.

Though America is in the highest degree self-sufficient, two main reasons demand our adoption of an international viewpoint of mineral resources: Our wealth carries its international responsibilities, and our future domestic independence is by no means certain. A striking illustration of this latter fact is afforded by the current statistics of the domestic oil supply, showing an increase in demand far exceeding production, a situation which has enlisted the active interest of American capital in the search for supplies of petroleum abroad. The establishment of foreign trade relations and the domestic industrial expansion resulting from the development of foreign mineral resources serve to emphasize the obvious connection between industry and commerce.

The preponderance of the fuel supply of the world assures to the northern hemisphere, and especially to the countries bordering the North Atlantic Basin, the possession of the centers of industry for centuries to come, an important factor in the political geography of the future. In the solution of the current problems of national policy in the fields of industry and commerce, a knowledge of the facts of commercial geology is necessary. This world outlook is essential, and yet the geographic center of our study must always be the United States, and our consideration of world resources should be related to our own national interest. A wise provision for an adequate supply of mineral raw materials, as well as regard for domestic industrial development, must be the safeguard of the future security of our industrial program. These principles represent the human side of mineral resources and the American side of commercial geology.

Notice Concerning the Current Volume of the "Geographical Review." The present number of the *Geographical Review*, covering the months of April, May, and June, completes Volume IX. The title page, table of contents, and index for this volume will be issued separately. A copy will be sent to each institution exchanging publications with the Society and, on request, to any one who desires to receive one.

The Society's supply of the February, 1920, number of the *Geographical Review* is exhausted. Fellows and others will confer a favor by returning to the Society any copies of this issue they may not care to keep.

EUROPE

A Notable Atlas of Population Distribution in Sweden. For some years Professor Sten De Geer of the University of Stockholm has been experimenting with methods of graphically representing the distribution of population. He has followed the wise plan of writing experimental articles and inviting criticism (Sten De Geer: *Befolkningens fördelning på Gottland, Ymer*, Vol. 28, 1908, pp. 240-253, with map, 1:300,000; Per Stolpe: *Till frågan om Gottlands befolkningsfördelning*, *ibid.*, Vol. 28, 1908, pp. 413-419; Sten De Geer: *Storstäderna vid östersjön*, *ibid.*, Vol. 32, 1912, pp. 41-87, with plate of 12 Baltic city plans, 1:100,000; Alfred Söderlund: *Förslag till intensitetsbeteckning vid konstruktion av täthetskartor*, *ibid.*, Vol. 35, 1915, pp. 267-272; G. A. Larsson: *Intensitetsbeteckningar vid kartografisk framställning av befolkningsfördelningen i tätare bebyggda trakter*, *ibid.*, Vol. 35, 1915, pp. 351-363).

He has thus perfected a method which is well-nigh ideal, and which has been employed in a beautiful atlas showing the distribution of population in Sweden, according to the census of January 1, 1917 (*Karta över befolkningsfördelning i Sverige den 1 januari 1917. Med statsbidrag utgiven av Sten De Geer. 1:500,000. 12 plates in atlas, 22½ x 16 inches. Stockholm, [1919]*). A small black dot indicates a hundred people. Villages or small towns up to a population of ten thousand are indicated by the appropriate number of dots placed where the people live in the country or arranged in rectangles to represent towns. For larger places he has evolved a symbol which is admirable because of the conspicuous way in which it stands out. The symbol is merely a small sphere shaded so as to stand out plastically. Besides this is placed a red figure showing the population in hundreds. Several sizes of spheres indicate the relative importance of the cities. The central sphere of Stockholm, surrounded by 12 satellites and by a great number of small black dots, is particularly interesting.

The atlas is accompanied by an explanatory text (*Befolkningens fördelning i Sverige: Beskrivning till karta i skalan 1:500,000 av Sten De Geer; 296 pp., Stockholm, 1919*). This is in Swedish, but at the end there is an English explanation of the signs used on the maps. The atlas shows not only the distribution of population, but the degree of cultivation, the limits of certain main types of prevalent industries, the lines of communication graded according to their importance, a large number of "lines of physical geography," and certain administrative and other boundaries. Topography, forests, geological structure, and the drainage basins of rivers are all indicated, as well as boundaries of fishing areas. So skillfully is this done that there is no confusion and the maps are easy to read even in the most crowded portions. The scale, 1:500,000, has obviously been chosen with the needs of the more densely populated regions in mind, for in the sparsely populated north it leaves great areas almost blank.

This atlas, taken in conjunction with the atlas illustrating the Swedish agricultural census of 1900 (*Sveriges jordbruk vid 1900 talets början: Statistiskt kartverk utarbetadt af Wilhelm Flach, H. J. Dannfelt, Gustav Sundbärg, 262 pp., Göteborg, 1909*), places Sweden well in advance of any other country in the skill and accuracy with which it has been mapped. While other countries may excel Sweden in large-scale maps of small areas, no other boasts an atlas which gives so comprehensive and accurate an idea of the life of the people. It is a pity that the United States cannot rival Sweden.

The lead of the Scandinavians in these matters is shown by the fact that a similar atlas on Norway is now in preparation by Mr. Söderlund, one of Professor De Geer's students, in collaboration with Norwegian authorities. The Swedish geographers in Finland are also considering a similar map of that country. The geographers in those countries wonder why Americans do not do a similar piece of work. As Professor De Geer puts it in a personal letter: "When I consider the 'power of initiative' of American geographers and their strong demand for clearness and sense for practical use, I hope that they will accomplish a gigantic map of American population perhaps as soon as we shall have a complete map of Northern Europe or at least of the Fenno-Scandian natural region."

ELLSWORTH HUNTINGTON

ASIA

The Climate and Weather of Mesopotamia. British occupation of Mesopotamia has already been productive of important scientific work. A report on the "Climate and Weather of 'Iraq'" (printed and published in Bagdad in 1919), by Lieutenant C. W. B. Normand, gives a very clear and graphic description of the essential meteorological and climatic characteristics of a region the ancient historical interest in which has been renewed by the consequences of the late war. The term Irak applies to the flat alluvial plain lying between Bagdad and the Persian Gulf and is identical in its boundaries with the ancient land of Shinar, the home of the Babylonians. Without its two master rivers, the Tigris and the Euphrates, Irak would be almost a barren desert. When this land was watered by the Babylonian canal system, it was the richest country of Asia and the earliest center of civilization. Without a very perfect system of "river training," marshes are bound to occur along the lower courses of the rivers, which at all times have silted up one channel after another and at intervals have spread disastrous floods over the land. The story of Noah's flood is associated with the earliest history of the region. The probability is "that the Deluge, of which memory is preserved in the legend, was brought down by the rivers and followed a remarkably rainy month in the plains, when copious rain must also have fallen amongst the hills at the headwaters of the rivers."

The climate of Irak is "continental subtropical," i. e. it has large diurnal and annual ranges of temperature, a small vapor content, and scanty rainfall. A moderate estimate gives an annual evaporation of 10 feet, while the rainfall just exceeds half a foot. A small area only is at present productive, through irrigation. The prevailing condition is that of an almost barren wilderness, with scattering camel-thorn and with thin patches of herbage in spring. There are two main seasons. Practically all the rain falls in "winter," from November to April. The rest of the year is marked by oppressive heat and an almost complete absence of rain.

During the winter the main weather control is exercised by a succession of cyclonic depressions, of which there are three or four a month, coming from the eastern Mediterranean or Asia Minor. On the whole the conditions during the six cooler months are pleasant and invigorating. Most of the days are clear or only partly cloudy; the nights are chilly; severe frosts occasionally occur in the early mornings.

In the transition period (March to May) the temperature rises rapidly; the rainfall becomes more and more of the thunderstorm or squall type; flies and other insects are a source of discomfort.

During the hot weather the prevailing winds are northerly, under the control of the great low-pressure system over southern Persia, Baluchistan, and northwestern India. These winds are dry and hot. There is neither rain nor cloud. "To the city inhabitants the hot weather is a period of existence in thick-walled and even underground rooms by day, and on the roof by night." Some relief is found in the *shamal*, a high northwest wind of 20 to 40 miles an hour which blows for periods of several days at a time in June, July, and August. The *shamal*, while often dusty and disagreeable, brings some alleviation from the oppressive heat by lowering the day temperatures and acting as a natural and efficient punkah. In the opinion of most people who have had experience in both climates, Irak is to be preferred to northern India in summer, for in the former region the nights are less unpleasant, there is usually a breeze, and conditions are more favorable for sleeping.

Lieutenant Normand is emphatic in his opinion that climate has not changed in Babylonia. "There exists neither historical nor geological evidence to indicate any appreciable change of climate within historical times beyond the local changes due to a general system of irrigation and the more northerly position of the seaward end of the delta. . . . Throughout history there are evidences of the liability of the rivers to sudden floods, and according to Willcocks, the water supply of the rivers was inadequate in those days, as at present, for the irrigation of the whole of the irrigable land. The general archeological view, indeed, is that the climate has undergone no appreciable change since the days of the Babylonian Empire."

This report deals mainly with Irak, but numerous tabulated observations from the neighboring submontane and mountain districts, and also from the Persian Gulf, are included because of the meteorological interdependence of all these regions.

R. DEC. WARD

POLAR REGIONS

A Recent Drift in the Kara Sea. A remarkable drift voyage has recently taken place in the Kara Sea. On January 22, 1920, the Russian icebreaker *Solovye Budomiro-*

rich (2500 tons burden; equipped with wireless) left Archangel, making for Cheskaya Guba, the large bay east of the White Sea. The aim of this winter journey was to load a complete cargo of reindeer meat on this coast, frequented by Samoyeds. The crew and passengers, including five women, numbered 85. Three days later, off the White Sea, before entering Cheskaya Guba, the ship was beset and then drifted in a generally easterly direction. Always locked in the pack, she was driven through Kara Strait and entered the Kara Sea, where she pursued her drift in a zigzag course. The current first drove the vessel northeast and soon after southeast. Then followed a drift almost due east and subsequently north-northwest. According to wireless messages received from the Russian icebreaker, her successive positions to April 20 were found to be as follows:

March 23	72° 39' N. lat.	62° 9' E. long.
April 6	71° 5' " "	62° 8' " "
April 14	71° 4' " "	64° 27' " "
April 20	72° 8' " "	63° 43' " "

As soon as a wireless message from the *Solovye Budomirovich* telling of her dangerous position—there was then no more coal on board and food was scant—was received by the Archangel station, the Russian Soviet government called by wireless on the Norwegian government to rescue the ship in distress, insisting on the humanitarian purpose of such an enterprise. The Norwegian government agreed, and a rescue expedition was organized. No strong ship being available in Norway, the British government loaned a powerful icebreaker, the *Sviatogor*, and Captain Otto Sverdrup, the celebrated Polar explorer, volunteered as leader of the expedition. Dr. Breitfuss, the well-known Russian oceanographer, was a member of the staff. The expedition was provided with two airplanes for detecting the position of the distressed ship. The *Sviatogor* left Bergen on May 12 for the Kara Sea. This spring there was unusually little ice in the Arctic north of Europe. Navigation on the west coast of Spitsbergen was open early in May, and according to the Christiania newspaper *Aftenposten* a steamer reached Vardö in the first days of May from Archangel without encountering a single bit of ice in the White Sea. There is no previous record of the west coast of Spitsbergen and of the White Sea being open so early.

A wireless message from the *Sviatogor* received in Christiania on June 21 announced the finding of the *Solovye Budomirovich* by the *Sviatogor* and the rescue of her full complement, all of whom were taken aboard the British vessel. Details of the later part of the drift will be awaited with interest.

CHARLES RABOT

HUMAN GEOGRAPHY

Atmospheric Conditions Which Affect Health. In the *Quarterly Journal of the Royal Meteorological Society* for July, 1919 (pp. 189-207), Professor Leonard Hill, of the University of London and the Medical Research Committee, contributes an unusually interesting and valuable article on "Atmospheric Conditions Which Affect Health." He begins by raising the question whether the ordinary meteorological records really measure the conditions which chiefly influence mankind. Under ordinary circumstances barometric pressure, "which is measured with such refinements of accuracy," has practically no effect upon human health or feelings, as Hill demonstrates by experiments in deep-sea diving and in closed chambers. The proportion of carbon dioxide and of oxygen in the air also has no importance in producing discomfort or ill health except under circumstances far more extraordinary than those of the most poorly ventilated mines or offices. The old ideas as to the exhalations from human beings and the supposed toxic poisons thus produced "have been swept away by the overwhelming evidence of physiological research. . . . The victims of the Black Hole of Calcutta died from heat stroke, not from poisonous vitiation of the air by the exhalations of the crowd." Ionization and the production of ozone may perhaps have some effect in making some air "alive" and other air "dead," but this is by no means proved. "It is the cooling and evaporative power of the atmosphere and the radiant heat of the sun, or other source of radiant energy, which have a colossal effect on our comfort and well-being, and it is these factors which require to be measured by the student of hygiene."

As a means of measuring these factors Dr. Hill has devised the "katathermometer," an instrument which measures the speed with which a thermometer drops 5°F. upon exposure to the air after being heated to 100°. This instrument, when dry, sums up the combined cooling power of radiation and convection; when covered with a wet

film of muslin, it measures the effect of these two conditions, plus the cooling effect due to evaporation. It is unquestionably a most useful instrument and ought to be used widely for regular daily observations.

Some of the conclusions which Dr. Hill derives from his katathermometric studies are highly suggestive and of great practical importance: "The expectation of life of the purely industrial population among those who survive over 15 years is 49 to 50 years; of the purely agricultural population, 67 years. Were the agricultural population better housed and better fed their expectation would be, I believe, more like 87 years. The sheltered indoor life of those who work in warm rooms and live in stuffy tenements does not protect from but increases the incidence of consumption and other diseases." . . . "The common people seek to save, and, in truth, destroy life, by avoiding cold and shunning exposure to bad weather and by confining their children within doors and limiting their exercise—this they often do for the sake of keeping clean and untorn the garments, while weakening the bodies, of their children." . . . "*The ordinary indoor conditions of this country [England] approximate to outdoor conditions in such a humid tropical climate as Ceylon, admittedly an enervating climate to Europeans.*" [The italics are Hill's.] . . . "Two hours a day of open-air exercise fully compensates for sedentary work in warm enclosures, keeps a man perfectly fit, and secures an enjoyment of life and good temper which no indoor recreation can give." . . . "I attach great importance to the radiant energy which pours into us when out of doors, and I say the open fire or gas-fire giving radiant energy is the right method of warming in our misty climate." . . . "The ideal spring day out of doors gives us sunshine, a warm ground, and cool moving air. These are the conditions we want to imitate in our rooms." Presumably the gas-fire here suggested means one where the fumes go up the chimney and thus cause circulation of the air.

If such are the conditions in England, which the reviewer is growingly convinced to be the most favored of all countries so far as the effect of climate upon human health is concerned, what shall we say of the United States? Every argument for outdoor life which applies in England applies with redoubled force here—where the danger of respiratory and nervous diseases is distinctly greater.

In spite of its general excellence Dr. Hill's work needs amplification and amendment in certain respects. For example, so far as one can gather from the present article, he relies too much on mathematical deductions and not enough upon facts of observation, or rather, although he has made many observations and experiments with the katathermometer, he seems to correlate these with the conditions of health theoretically rather than by actual statistics of energy, disease, and death. Perhaps this seeming weakness will disappear in the fuller publication which is soon promised.

Again, his statements as to the climate of the United States are not quite convincing. The net cooling power of the atmosphere, so he says, is considerably greater in England than in Washington, "whence it follows that the British require an ampler diet than the Americans of the United States—a question of fundamental importance in food rationing times, which the American physiological experts were at first inclined to settle against us." Dr. Hill seems to overlook the fact that Washington is by no means typical of this country and has on the whole a rather poor climate. The majority of the people of the United States live where the climate is cooler, more variable, and more stimulating. In this connection it is noticeable that, although Dr. Hill by implication lays much emphasis upon the value of variability in promoting health, he does not specifically recognize this highly important factor.

The chief respect in which Dr. Hill's work needs amplification arises from the fact that for each climatic condition there is an optimum or most favorable level, so to speak, above or below which the effect is less and less favorable. In England more harm is done by too much humidity than by too little. Having carried on his investigations in such a climate, Dr. Hill gives the erroneous impression that dryness is everywhere desirable. Yet the evidence of millions of deaths proves the contrary. In the hospitals of Boston, for example, after operations performed in unusually dry weather the number of deaths rises about 20 per cent above the average and about 40 per cent above the number when the operations are performed under conditions of favorable humidity, such as prevail perhaps one-fifth of the time.

In spite of these criticisms Dr. Hill's paper is of uncommon value. In an old and well-established subject it is easy to satisfy the critic, but in a subject, like this, which breaks new ground there are bound to be many inconsistencies and many points which demand further study. Such a paper is especially valuable as a stimulus to others to plow in the same field.

ELLSWORTH HUNTINGTON

The Origins of Civilization. Recent numbers of the *Scientific Monthly* have contained several contributions of geographical interest. One of these, a series of articles by Professor J. H. Breasted of the University of Chicago, discusses the origins of civilization (Vol. 9, 1919, 289-316, 416-432, 561-577, Vol. 10, 1920, 86-105, 182-209, 249-268). He begins by a discussion of the geographical conditions of the ancient world, especially Egypt at the dawn of civilization. Then from about 5000 B. C. he follows the course of civilization down to the days of the Greeks. His presentation is unusual and correspondingly interesting because it departs from the ordinary historic method of dealing only with rulers. He tells about the entire life of the people and about their relation to their environment. One of the most interesting features is a series of diagrams showing the evolution of different types of architecture, such as the pyramids and the cathedrals of Europe, from their simplest forms to their complex culmination. Another diagram worthy of careful study shows the comparatively steady progress of civilization in Egypt and Babylon and the irregular progress in Europe.

Professor Breasted ranks as a leader among historians who appreciate the geographic background. In a recent address (The Place of the Near Orient in the Career of Man, and the Task of the American Orientalist, *Journ. Amer. Oriental Soc.*, Vol. 39, 1919, Part 3, pp. 159-184; noticed in the *Review*, Vol. 8, 1919, pp. 285-286) he has presented an unusually strong and persuasive plea for co-operative investigation along various lines, including history, archeology, geography, and anthropology. Geographers would do well to read this address, for it gives a new appreciation of the relation of their science to other lines of effort.

ELLSWORTH HUNTINGTON

EDUCATIONAL GEOGRAPHY

The Extension of Meteorological Instruction. The emphasis which was laid upon the practical importance of a knowledge of meteorology during the war will inevitably lead to a general increase of popular interest in this science and to its more extended teaching. The war demonstrated the need of meteorological training in numerous ways, notably in forecasting, in aviation, and in artillery firing. The American Expeditionary Forces had their own meteorological observers and forecasters. The men who enlisted in the air service, either in the Army or the Navy, were given courses of lectures in meteorology as a part of their "ground school" training. And the artillery officers were instructed in the most essential facts regarding the temperature and the direction and velocity of the wind at various altitudes above the earth's surface. The U. S. Weather Bureau gave preliminary instruction, which was completed in France, to some two hundred engineers and other scientists. The Signal Corps of the Army established a School of Meteorology in Texas to train several hundred meteorologists for service overseas. A course in meteorology was included in the work of the Students' Army Training Corps. In these various ways the subject of meteorology was brought conspicuously before large numbers of men during the war, and the stimulus thus applied should surely lead to a much wider inclusion of the subject in the course of study offered at our higher institutions of learning.

Soon after hostilities ceased the *Monthly Weather Review* (Vol. 46, 1918, pp. 554-567) published a valuable series of papers on meteorology as a subject for study, which should prove very useful to all present and prospective teachers and students of the subject. The Weather Bureau deserves credit for including this symposium in its most popular publication just at that time. The articles are all of immediately practical use and should stimulate and aid in the more general introduction and the better teaching of meteorology in American colleges and universities. In the first paper, "How Meteorological Instruction May Be Furthered," Professor R. DeC. Ward takes the ground that two things are necessary. First, united effort on the part of those who are already in a position to give instruction in meteorology to send out students who will, in their turn, carry on that instruction. And, second, as meteorology has at present a recognized place in very few of our colleges and universities, teachers of physics, of geology, of geography, and of other sciences, who have any interest in meteorology, should make it their business to develop meteorological courses as a part of their own work. A discussion of "Collegiate Instruction in Meteorology," by Dr. Charles F. Brooks, contains many excellent practical suggestions as to the content of an elementary course in meteorology, of college grade. Three outlines of courses of lectures in meteorology are given. There are many suggestions as to the taking of daily observations and the graphic presentation, in a simple and vivid form, of the results of such observations. Brief comment is also made on the textbooks which are useful in this work.

Professor Oliver L. Fassig gives an account of the work which was done in the Signal Corps School of Meteorology at College Station, Texas, of which school he was chief instructor and director. At the time of the signing of the armistice, about three hundred men who had been trained at Weather Bureau stations and at the School of Meteorology in Texas had been sent abroad. About two hundred men were assigned to a score or more of the flying fields, artillery and ordnance camps, balloon schools and radio detachments in the United States. Twenty-five men were transferred to the Navy, for duty in connection with the development of the hydrophone, an instrument designed to detect the presence of submarines.

The series of articles here referred to has been reprinted in pamphlet form, and should come into the hands of all present and prospective teachers of meteorology.

In a later number of the *Monthly Weather Review* (Vol. 47, 1919, pp. 169-170) Dr. Charles F. Brooks summarizes the results recently obtained regarding the present extent of collegiate instruction in meteorology and climatology in the United States. The data were secured in reply to a questionnaire sent by Commissioner P. P. Claxton, of the Bureau of Education, to the presidents of colleges and universities in this country. Dr. Brooks says: "It is to be regretted that there are only three universities in the country where research in meteorology is specifically encouraged, and that even the semblance of a thorough course in elementary meteorology is given at only one in ten of the institutions of higher learning in the country."

GEOGRAPHICAL NEWS

OBITUARY

MAJOR ROBERT HOLLISTER CHAPMAN of Washington, D. C., died of pneumonia in New York City on January 11, 1920, at the age of fifty-one. He was widely known as a topographical engineer through his connection with the U. S. Geological Survey, which he joined as a youth of fourteen and continuously served for over thirty years. He did map work for the Survey in the Adirondacks of New York, in the Rockies near Butte, Montana, in the High Sierras of California and in the Death Valley region of California and Nevada. The latter work was noteworthy by reason of the difficult desert conditions overcome. In the Taft administration he had charge of Glacier National Park, which he also mapped.

In 1909 and 1910, at the request of the Canadian Geological Survey, he was detailed in Ottawa for the purpose of introducing American methods of surveying and mapping. The triangulation of Vancouver Island was initiated under his direction. In 1915 he explored the Big Bend of the Columbia River in British Columbia and in 1919 the region southwesterly from Yellowhead pass.

During the war, as a Major of Engineers (Reserve Corps), he was assistant to General Theodore Bingham in connection with the defenses of New York City and in the production of airplane maps.

He was a member of the American Geographical Society and of the Royal Geographical Society and at the time of his death was Secretary of the American Alpine Club. He was an enthusiastic mountaineer and a skillful cartographer.

HOWARD PALMER

Note

Mr. Wallace E. Whitehouse, of the University College of Wales, Aberystwyth, calls attention to several inaccuracies in the note on "A Relief Model of Wales" in the February *Review* (pp. 141-142). Contrary to the implication of the note the whole model had been completed at the time of the publication of the handbook in 1915. Only 10 of the 66 blocks of the model were described, as is pointed out on p. 22 of the handbook, in order to keep the handbook of a small size and low price. Mr. Whitehouse was not responsible for the whole of the modeling work. Professor H. J. Fleure directed it in the early stages, and later Mr. Whitehouse took charge and was ultimately responsible for the modeling of 34 blocks and the revision of the other 32. The note speaks of the "apparently artificially softened modulation of the blocks." This is more apparent than real. The plates in the handbook are halftone views of highly glazed cement blocks, and all who have had experience of photographing such objects appreciate the difficulty of getting an accurate photograph for reproduction purposes.

GEOGRAPHICAL REVIEWS

SCIENCE AND POLITICS

VICTOR BRANFORD AND PATRICK GEDDES. **The Coming Polity: A Study in Reconstruction.** xvii and 264 pp.; maps, ills. (The Making of the Future.) Williams & Norgate, London, 1917. 8 x 5 inches.

On the surface this is a plea for the application of the method of science in political thinking. As such it is noteworthy. It merits approval also for its appeal that the work of LePlay should receive wider recognition at the hands of English-speaking students of geography.

As projected, the book is introductory to a series "scientific in method and prospective in outlook." One is curious to know, however, whether science is supposed to intrude itself in the present volume. The procedure actually followed seems to be, in the words of the authors, a search for clues to causes carried out by "wandering to and fro between metropolitan capitals and their provincial cities, with the formulae of Comte and LePlay in mind, and not forgetting those of Darwin" (p. 151). In the same spirit Comte is commended as "a kind of naturalist who went about peering into societies past and present, discovering beneath all disguises and mutations his four perennial types" (p. 23).

The authors seem to move in a dream world under the guidance of a science and a history of their own invention. "May not the city be the long-sought missing link between animal and human evolution?" (p. 153). "Without continuous revitalizing [by the periodic fair], the spiritual organs of a city wither and formalize, or ferment to active degeneracy. . . . To this city of evils there comes from time to time the Good Shepherd to seek and to save that which was lost. And from it flees Christian, the Pilgrim, in search of the Celestial City of his dreams" (p. 143). To these regionalists, the shepherd on the hillside is the veritable savior of society: "it is only in the pastoral life that self-sacrifice develops directly from the occupational disposition, in highest sanctity of moral elevation" (p. 124). They have similarly amazing labels for all classes: "the hunter is the man of imagination" (p. 122); "it is the peasant who is *par excellence* the builder" (p. 131); the philosopher is kin "with the dreamy and dreary loafer, with the restless and careless tramp, rustic or urban, as the case may be" (p. 117).

This is not science. The book might be described as the result of an effort on the part of belated mystics to create a "regionalistic" religion out of the incompatible teachings of Auguste Comte and Frédéric LePlay. FREDERICK J. TEGGART

THE ECONOMIC HISTORY OF AUSTRALIA

T. A. COGHLAN. **Labour and Industry in Australia from the First Settlement in 1788 to the Establishment of the Commonwealth in 1901.** Vol. 1, viii and 587 pp.; Vol. 2, vi and pp. 589-1185; Vol. 3, v and pp. 1187-1789; Vol. 4, v and pp. 1791-2449; index. Oxford University Press, London, New York, etc., 1918. \$33.00. 9 x 6 inches.

This is a work of very considerable volume and value but one difficult to classify. The author says that while it is "a history of Labour it is not a history of Australia." However, his definition of "labor" is so liberal that these four volumes really contain a topical record of Australian industrial society from 1788 to 1901. American readers would be more interested in the events of the past twenty years—particularly in the field to which Mr. Coghlan especially devotes himself—than those of all the one hundred and thirteen years preceding. Yet Australia's recent legislative experiments, which are mainly what make that country interesting to outsiders, cannot be understood without knowing this earlier period.

Additional value is given the book by the fact that it is the logical fruit of the author's life work. It might be subtitled "The Professional Memoirs of a Statistician," allowing the latter term very comprehensive implications. The Australian states and New Zealand have had superior statistical offices for many years—immeasurably better

than most of those in America. After becoming a veteran in this service in New South Wales, where he was Registrar General for a long period, Mr. Coghlan was Commonwealth Statistician—a position which he held with distinction until promoted to higher duties at London. As administrator and editor successively of the New South Wales Year Book and of the Commonwealth Year Book, he dealt continuously with the subject-matter of his present work. This work is the precipitate of a lifetime of study and labor. He did not go out to find a subject and write it up; the topic intruded itself upon him, and its materials were already accumulated and arranged at his elbow.

This does not mean that the book is a statistical manual or a compilation of official reports. Only rarely does a short and simple tabulation break the continuity of the text. The author's style has literary quality; his chapters are narratives as well as analyses; and his descriptions are enlivened by incidents, anecdotes, and personalities. The volumes are not burdensome to read, though their length, detail, and subject-matter will limit their appeal mainly to the student.

The arrangement is partly chronological and partly topical. These one hundred and thirteen years of Australian history are divided into seven periods, bounded in each instance by a political or economic episode of importance, such for example as the discovery of gold, or the great panic of 1893. Events within each period are discussed by topics, under subject headings varying from period to period in accordance with the country's changing industrial problems and development. Some subjects, like immigration, labor and wages, land laws, and prices, recur constantly; but convict settlement, indentured labor, and factory legislation are naturally not contemporary topics.

Within the field to which he confines himself Mr. Coghlan speaks with authority. He writes without footnotes, documentation, or bibliography—merely acknowledging in his preface the aid received on special topics from three coadjutors. He resembles our own historian, McMaster, in drawing largely upon the daily press; and, for the latter part of the period he describes, he was in many cases the writer of his own archives. His statistics are merely illustrative and descriptive, partly because such treatment satisfies the purpose of the book and partly because data do not exist in many instances for more refined and elaborate methods of presentation. To an American reader there is something parochial in the minute personal detail that characterizes the political chapters. One meets catalogues of names that mean nothing—and deserve to mean nothing—to the outside world; and more than once the reader sees genius lauded whose brilliance must have illuminated a southern firmament from which no reflections reached our northern horizons.

However, it would be difficult indeed to write a work of this magnitude for Australians—who after all are entitled to first consideration—which would be consistently interesting for Americans. In fact for us Mr. Coghlan's work will remain a discursive reference book—a sort of monographic encyclopedia—of the industrial and social *origines* of Australian legislative experiments.

It is hardly practicable here to deal with the periods and topics in detail. But by following any one of the topics, such as the public land policy or the labor supply, a reader quickly catches the antithesis between the evolution of Anglo-Saxon law and institutions in America and in Australasia—a contrast which goes far toward explaining the marked difference in the theories that inspire their respective legislation. Australia and New Zealand were ready-made colonies, founded at a time when Great Britain was a veteran in such enterprises and had conscious theories about them based on past experience. There were theories enough and public discussion enough when America was settled by Englishmen, but our colonies none the less grew up like Topsy. The twist given to Australia's institutions by the fact that it was at first a convict settlement—founded to dispose of persons Great Britain could no longer send to America after we attained our independence—has lasted until today; although the convicts themselves were but a transient element in its history. The original purpose of the settlement made necessary a highly centralized and paternal government. Government control, government regulation, and government aid were the tripod which supported the colony's economic life. Even the individualism of the gold rush did not destroy the collectivist instincts thus begotten. To be sure it was a self-reliant collectivism of pioneers and frontiersmen; but none the less absolutely different from the individualist and self-dependent habits of thought and action which inspired our own pioneers and settlers. Our decentralized society was largely rural while our political institutions were forming; that of Australia was predominantly urban almost from the outset. Our government was a running machine before the industrial revolution, while Australia's was erected under the tutelage of a highly industrialized mother country. So in Australia social ideals imported from a nation maturer than our own confronted physical conditions quite as primitive as those which existed in America. The result has been a unique application of new-country initiative to Old World problems.

These volumes do not cover the period when compulsory arbitration had become fully established as a method of dealing with labor conflicts; but the author allows himself to trespass diffidently upon this subject in his discussion of labor legislation between 1893 and 1901. He says that while "it is certain that the Courts and the Wages Boards do much to smooth the relations of employers and employed . . . events have shown that Labour will not always accept the awards of arbitration nor refrain from striking, and the employers only are bound by the awards" (pp. 2115-2116). Having been in operation only during a period of rising prices and wages "it has yet to be seen how arbitration will work in a period of trade depression and a failing labour market" (p. 2116).

All in all the book is a worthy one—indispensable for a library affording really important source materials upon geography and modern social and economic history. Its private purchasers will probably be chiefly specialists in land or labor legislation or economics, and they will seldom have to go beyond its covers for any information they may require regarding Australia during the period before the formation of the Commonwealth government.

VICTOR S. CLARK

RAMBLES IN THE CATSKILLS

T. M. LONGSTRETH. **The Catskills.** 321 pp.; map, ills., bibliogr., index. Century Co., New York, 1918. \$2.50. 8½ x 5½ inches.

A charming book, fitted to enhance the enjoyment of all intelligent dwellers or sojourners among these fine hills. It is not a mere guide or reference book but a work worth while as a bit of literature, very pleasant to read, full of humor and incident as well as of solid fact. With all this lightness of touch, the whole work is permeated with the essence of the Catskills, the things that bring over 100,000 visitors every year from Greater New York to rest a while, exercise "that tired feeling," and go home rejuvenated.

The author sets forth all kinds of truth about these mountains. He has walked everywhere among them and almost photographs hill and vale in words. If he talks of their delicate charm he also says that in the dog days, when New York City is hot, the Catskills are hot too. The fact is that the average summer daylight temperatures of the Catskill plateau, where people live, are only about ten degrees lower than those of the city. But the air is dry, children run around on the hottest days in the shade, and complete relief comes after sunset.

THE PHYSIOGRAPHY OF NORWAY

H. W. AHLMANN. **Geomorphological Studies in Norway.** Maps, diagrs., ills., bibliogr. *Geogr. Annaler*, Vol. 1, 1919, No. 1, pp. 1-148; No. 2, pp. 193-252. Stockholm.

The Swedish Society for Anthropology and Geography, founded at Stockholm in 1877, has hitherto been known to us chiefly through its journal, *Ymer*, now in the 40th year of publication. The newly established *Geografiska Annaler*, "the purely scientific publication of the Society, . . . will be an international periodical, written mainly in the great world-languages, but also in the Scandinavian languages, devoted to general geography, and especially to the geo-physical investigations which at the present time flourish so greatly in Scandinavia. The students of all countries are welcome as contributors *Ymer*, on the other hand, will be published exclusively in Swedish and will give accounts of studies and investigations of consequence in the wide field of geography, especially paying attention to what lie within the domain of economic geography."

The first two numbers of the new *Annaler* are largely occupied by an analytical study (published in English) of Norwegian land forms by Ahlmann, who spent ten months of 1916 and 1917 in observational travel. He adopts the prevailing view that the highlands of Norway represent a generally worn-down surface, afterwards upheaved, and gives special attention to the conditions and results of its later dissection. Here he distinguishes two incomplete cycles of normal erosion, during the first of which mature valleys were excavated beneath the highlands, and during the second young valleys were incised in the floors of the mature valleys. The mature valleys are found to be less mature when followed up to their heads; but they are more mature when followed down to their mouths; there they are described as so greatly widened as in large measure to consume the intervening highland areas, which are there of moderate altitude. Thus the "coast plain" of Norway, which Reusch ascribed to wave work, is interpreted by Ahlmann as of subaërial origin. Glaciation is recognized as having excavated

the deep fiords and as having strongly modified the coastal lowlands. The large importance recently given by Sederholm to faults in the production of fiords is denied.

Ahlmann's essay is well illustrated by half-tone views, maps, and sketches; and an elaborate bibliography is given at its close. As is usual in analytical essays, geographical description here occupies less space than argumentative demonstration, and the past thus comes to hold a larger share of the reader's attention than the present. This relation is likely to prevail in such studies until the results of analysis are so well assured as to be generally accepted. For example, twenty years ago the origin of hanging lateral valleys was in discussion; now their origin is settled, and they are referred to as well-understood elements of certain landscapes. Progress in this respect is rapid. We may expect that our successors thirty or fifty years from now will use the results of our argumentative analyses in their everyday descriptions. In the meantime, the results gained at present would be more generally appreciated and used by economic geographers, historians, and others, if they could be gathered in a continuous descriptive statement which would satisfy most readers, but from which any reader might turn to the analysis if he wished to learn the evidence upon which the account of any item is based.

Regarding Ahlmann's explanation of the coastal lowlands, it may be noted that wave work should expectedly have had some share in carving the margin of the highlands; for the upheaval of the pre-existent lower lands appears to have been of a warping nature, probably accompanied by depression along the ocean border; and upon the shore line thus initiated the waves of the Atlantic must have accomplished a good amount of abrasion while the rivers were maturing their valleys in the interior and widening them to the confluent lowland of today near the coast. The two processes should therefore not be regarded as mutually exclusive, although the shares that they may have had in wearing down the uplifted land mass may have varied from place to place. Around the present coast of southern Norway wave work may have been weak during the cycle of erosion in which the mature valleys were excavated, for at that time a large part of the North Sea may have been dry land; hence the lowland there may be largely ascribed to valley widening. But along the mid-western coast, where the ocean waves came in unobstructed from deep water, a certain share of the lowland may be plausibly regarded as of marine origin, particularly in districts where the present ascent from the lowland to the highlands is abrupt. This possibility is given less consideration than it appears to deserve.

It is gratifying to read Ahlmann's statement in his preface: "During my journeys, and also in the treatment of the observations made in their course, I have followed the general principles of geomorphology which have been worked out in America. . . . Indeed I consider that, without the conception of 'cycle,' it is scarcely possible to bring any order into, or obtain any unity in, the complex of heterogeneous topographical elements that compose the Norwegian land of the present day." W. M. DAVIS

THE MOORS OF FINLAND

A. K. CAJANDER. *Studien über die Moore Finnlands*. Maps, diags., ill. *Fennia*, Vol. 35, No. 5, pp. 1-208. Helsingfors, 1913-15.

This report on the moors of Finland is supplied with two maps in color on the scale of 1:20,000 and a map of the route traveled in the botanical and ecological exploration of this country of forest, lakes, and moors, with rivers emptying into the Gulf of Bothnia, the Gulf of Finland, and the White Sea. The author, one of the foremost Finnish botanists, has had abundant experience in making similar surveys in Siberia and elsewhere in Europe. The work consists of an introduction, which gives the author's general point of view, a general part (pp. 5-85), and a special part (pp. 89-208).

Moors are defined differently according to the viewpoints of those who make a study of them. If defined from the geological viewpoint, they are natural places where peat is found. The biological, or rather ecological, definition is that a moor is a plant formation consisting of peat-forming plants. Dr. Cajander all through his report lays especial emphasis on the ecological phases of moors, and several pages are devoted to an introductory discussion of the various types of moors, which have been described and named by ecologists who have made telmatology their special line of investigation. The current views on high moors (*Hochmoore*), low moors (*Flachmoore* and *Niedermoore*), transitional moors (*Zwischenmoore*) are analyzed in several pages of footnotes. After sifting the evidence, the author concludes that in Finland there are four moor types, as follows:

(1) Gray moors: treeless, normally more or less wet and overflowed, without moss ricks (rounded, elevated parts of the moor), poor in shrubs (except *Oxycoccus* and

Andromeda); the moss vegetation, as far as present, consisting of peat mosses (*Sphagnum*). In calcium-poor regions.

(2) Brown moors: treeless, normally more or less wet and overflowed, without moss ricks, moderately poor in large shrubs; the moss vegetation, as far as present, consisting principally of so-called brown mosses (various *Amblystegia*, *Hypnum trichoides*, *Paludella*, *Meesea*, *Cinclidium*, etc.). In calcium-rich regions.

(3) Shrub moors: little, or scarcely, overflowed moors with or without ricks, with more or less abundant vegetation of moderately tall shrubs; the moss vegetation being formed principally of Sphagneae and the forest growth, nearly always present, consisting principally of more or less twisted and dwarfed pines (*Pinus silvestris*). In calcium-poor and calcium-rich regions. The ground water more or less stagnant, or very slow-flowing.

(4) Tree moors: forest moors, the woody growth consisting of spruces (*Picea excelsa*) and broad-leaved trees, the pine unimportant; the moss vegetation consisting normally of peat moss and bear moss (*Polytrichum commune*) or with true mosses in increasing numbers. The ground water more or less distinctly flowing. In calcium-poor and calcium-rich regions.

The origin of the Finnish moors is to be attributed to the filling of shallow lakes and lake basins with encroaching plants and to the invasion of moor-forming plants into flooded lands or into forests. The principal moor-forming plants of the first category are *Equisetum fluviatile*, *Carex rostrata*, *Heleocharis palustris*, *Hippuris vulgaris*, *Alisma-plantago-aquatica*, *Sparganium simplex*, *Lysimachia thyrsiflora*, *Menyanthes trifoliata*, and a number of hydrophytes, as *Lemna minor*, *Utricularia vulgaris*, and other water plants of the genera *Potamogeton*, *Nymphaea*, and *Nuphar*. Much less frequently, and principally only in southern Finland, appear *Sparganium ramosum*, two species of *Typha*, *Glyceria aquatica*, *Scolochloa arundinacea*, and *Carex stricta*. The remains of all these plants with the mud-covered earth contribute to the formation of the layers of peat. The other method of moor formation by the flooding of river valleys with water is described at some length by Cajander with the aid of maps in the text.

In the development of the moors a variation in the amount of moisture is very frequent. This is observable in the growth of a moor from a shallow lake and in the invasion of a forest by bog mosses and typical moor plants. *Sphagnum fuscum* is one of the principal bog mosses active in raising the ground-water level in the formation of moss ricks. The growth of the Scotch pine on the gray moors, shrubs moors, and cotton-grass moors has been studied and plotted by the author in relation to the development of these kinds of moors. The moor complex is then described in great detail, with the aid of outline and colored maps, for the high moors of different geographical types.

The special part of the monograph deals with the types of moors in Finland; and each section, under the headings Gray Moors, Brown Moors, Shrub Moors, and Tree Moors, is introduced with a definition of each type printed in italics. The principal and characteristic plant species are given in detail for each type of moor. Some of the floristic details are listed under the heads of grasses, herbs, shrubs, and trees. The pages fairly bristle with the enumeration of the principal plants which enter into the different moor associations. Each of the twenty plates has two exceptionally clear photographic reproductions of the different kinds of Finnish moors.

The whole monograph is an exceptionally good piece of synecological investigation, and the author has succeeded in throwing considerable additional light upon a much confused subject. It would seem almost necessary to call a convention of ecologists and botanists in order to discuss the nomenclature of moors and bogs with the hope of bringing order out of chaos. Cajander has done a service in discussing the origin, nature, and constituent plants of the Finnish moors without emphasizing the distinction between high moors and low moors and in using other distinctive terms.

JOHN W. HARSHBERGER

THE FORMATION OF CORAL REEFS

T. W. VAUGHAN. *Corals and the Formation of Coral Reefs*. Maps, diagrs., ills. *Ann. Rept. Smithsonian Instn. for 1917*, pp. 189-276. Washington, D. C., 1919.

The first part of this paper presents an excellent summary of the anatomy of the coral organisms and of the ecological conditions under which they live. The results of many experiments by Vaughan, Mayor, and others on the conditions affecting coral growth are cited. Among these may be mentioned the relation to temperature, to light, to the salt content of the ocean, the capacity of corals to withstand exposure to the air, the method by which they catch their food and the nature of their food sup-

ply, the rearing of coral larvae, the duration of the free-swimming stage, and the rate of growth. The conditions for the vigorous development of reef-forming species are indicated.

A definition of a coral reef is proposed, and the necessity of distinguishing this type of structure from one composed primarily of calcareous algae is emphasized. An important section is devoted to varieties of limestone which frequently have been confused with coral-reef rock. These are oölitic limestones, shell sand, and limestones made chiefly of foraminiferal and bryozoan tests. Coral reefs are often associated with such deposits, but make up only a small fraction of the total mass. The distribution of the existing reefs is discussed. The reef-forming species are divisible into two biogeographic groups, the Atlantic and the Indo-Pacific. In the early Tertiary, the reef faunas of both oceans were identical, but the development of a land bridge between North and South America during the middle and later Miocene caused the differentiation, which became complete by the Pliocene.

The closing portion of the paper consists of a critical analysis of the important explanations of the origin of the reefs: (1) the Darwin-Dana subsidence theory; (2) the solution-erosion theory of Semper and Murray; (3) the still-stand theory; and (4), the glacial control theory. The solution-erosion theory is shown to be untenable, for solution is not important either in the lagoon or in the reef channels, and in the lagoon itself sedimentation predominates over erosion. The Darwin-Dana theory is discussed in detail especially with reference to the evidences of submergence. Vaughan concludes that "fringing reefs seem uniformly to have unconformable basal contacts," and that "they may form during either emergence or submergence" (p. 237). Barrier reefs and atolls develop on "antecedent flattish basements during and after submergence. . . . This generalization applies to fossil as well as to living reefs" (p. 237). The supporting platforms are believed to have been formed by various processes prior to the appearance of the reefs and independently of coral agencies. The nature of these processes and the manner of submergence have no bearing upon the later growth of the reefs. The formation of atolls by progressive changes in subsiding fringing reefs, as postulated by the Darwin-Dana theory, is theoretically possible, but Vaughan does not believe that actual examples exist.

The writer agrees with Daly that glacial controls have been of the utmost importance in the present development of the reefs. The supporting platforms, which are pre-Pleistocene in age, were subjected to certain modifications by marine abrasion during the lowered sea levels of the glacial period. In certain areas, as in the Fijis, in the Bahamas, and along the Florida coast, reefs are growing on "coastal flats that have been brought below sea level by tilting" (p. 238). From this Vaughan infers that "general submergence because of deglaciation is concomitant with local crustal deformation" (p. 237).

NORMAN E. A. HINDS

SECULAR CHANGES IN RAINFALL

C. E. P. BROOKS. **The Secular Variation of Rainfall.** Map, diagrs. *Quart. Journ. Royal Meteorol. Soc.*, No. 191, Vol. 45, 1919, July, pp. 233-248 (discussion, pp. 246-248). London.

It has again and again been asserted that meteorological records present no evidence of secular changes in rainfall. In the present paper Mr. C. E. P. Brooks, however, vigorously attacks this idea. His method is to use departures of rainfall from normal as one factor and the length of time before or after the central year of a given series of observations as the other factor. In this way it is possible to use the exact mathematical method of correlation coefficients. Mr. Brooks has gone to the great labor of working out some two hundred of these coefficients. On this basis he has prepared a map of the world showing the general tendency of the rainfall during the period since observations are available. While there are many coefficients too small to be significant, there are enough large ones to indicate certain general tendencies. The map shows: (1) a marked increase of rainfall in the main land mass of eastern Europe and northern and central Asia and a hint of the same thing in Canada; (2) a general decrease in low latitudes from about 40°N. to nearly the same latitude in the southern hemisphere; and (3) a hint of increased rainfall in the far south. Although the whole matter is still in its initial stages, Mr. Brooks seems to have demonstrated that opposite kinds of changes in rainfall are actually taking place in different parts of the world in cycles longer than any for which complete records are yet available.

ELLSWORTH HUNTINGTON

FREE-AIR CONDITIONS

W. R. GREGG. Average Free-Air Conditions as Observed by Means of Kites at Drexel Aerological Station, Nebr., During the Period November, 1915, to December, 1918, Inclusive. Diagr., bibliogr. *Monthly Weather Rev.*, Vol. 48, 1920, No. 1, pp. 1-11.

Two years ago, Mr. Gregg, in charge of the aerological division of the Weather Bureau, published a summary of the free-air conditions above Mt. Weather, Virginia (*Monthly Weather Rev.*, Vol. 46, 1918, pp. 11-21). The data on winds, pressures, temperatures, and densities proved to be so valuable in the aviation and artillery branches of the army that a similar summary of the observations made by means of kites over the Great Plains was undertaken and is now published. A few striking features are worth mention. Although March is warmer than February, April is colder than March at all levels from 1.5 up to 5 kilometers at least; in winter the temperature at a height of 2 kilometers is higher on the average than at the surface; wind velocity at all seasons practically doubles in the lower 500 meters; and, no matter what the surface wind direction, the wind at 5 kilometers is usually from between southwest and northwest, the north-of-west directions aloft being associated with surface winds around to northeast, and the south-of-west directions aloft being above surface winds southerly or easterly as far as east-northeast.

Little attempt is made to discuss the data, except to make clear their degree of accuracy and how the averages were made and to bring out the salient features of the tables and some contrasts with data obtained in Blue Hill and Mt. Weather kite flights. Obviously, the Weather Bureau's daily operation of kite stations is rapidly adding a third dimension to American climatology.

CHARLES F. BROOKS

CORRESPONDENCE

The University, Sheffield, England,

February 18, 1920.

To the Editor of the "*Geographical Review*":

In his interesting article on Norwegian work in Spitsbergen published in the *Geographical Review* for October-November, 1919, M. Charles Rabot has allowed his well-known admiration for Norway to distort his outlook on the work of British mining companies in Spitsbergen. But since his facts are avowedly taken from Norwegian sources, not in all cases of recent date, this is intelligible.

Certain historical statements, however, require correction. M. Rabot disputes the position of Spitsbergen as a *terra nullius* up to the recent date of Norwegian sovereignty. In this he is wrong. Norway-Denmark's sovereignty of Greenland could not, as he asserts, embrace Spitsbergen when once it was discovered that Spitsbergen was not part of Greenland. This fact was established early in the seventeenth century and disposes of all Danish claims. Moreover, M. Rabot seems unaware that Norway, Sweden, and Russia, discussing the Spitsbergen problem in 1912, proposed a settlement in which the first words were "*Spitsbergen skal forbli terra nullius*" (Spitsbergen shall remain a *terra nullius*). Furthermore at the Spitsbergen Conference held in 1914 the participating powers met on the distinct understanding that Spitsbergen was a *terra nullius*. This was pointed out in my article on Spitsbergen in the *Geographical Review* for May, 1919. These historical facts are of importance in their bearing on the recent decision of the Paris Conference to give Norway sovereignty in Spitsbergen. This sovereignty is not operative in non-Norwegian estates, which to all intents and purposes are extra-territorial.

Yours faithfully,

R. N. RUDMOSE BROWN

INDEX

A

- Adams, Cyrus C.
 Review of Baltzer's "Die Kolonialbahnen, mit besonderer Berücksichtigung Afrikas," 147
 Review of Boerker's "Our National Forests," 220
 Review of Farrer's "On the Eaves of the World," 218
 Review of Howe's "The Land and the Soldier," 214
 Review of Muir's "The Cruise of the Corwin," 148
 Review of Revelière's "Les énergies françaises au Maroc," 73
- Aegean region, 200
- Aerodromes in Africa, 154
- Africa
 Colonial railroads, 147
 Cotton growing, 35
 Population, non-increase, 179
 Trans-African flight, The recent, and its lesson (with map and ill.) (Walmsley), 149-160
- Agriculture
 Geography of the World's Agriculture (Finch and Baker), *rev.*, 74
 Scientific, 181
- Ahlmann, H. W.
 Geomorphological Studies in Norway, *rev.*, 368
- Air. *See* Atmosphere; meteorology.
- Air pockets, 154; 155
- Airplanes
 African views from (ills.), 152, 153, 158, 159
 Commercial traffic and, 157
 Landing a hangar on Lake Nyasa (ill.), 155
 Trans-African flight, 149
See also Aviation
- Airships, suitability for African flight, 158
- Algeria
 Sahara and Libyan Deserts, *note*, 211
- Algiers-Cairo line, 68
- Aliens, control in China and the East, 306
- Al-tin, 112
- Altitude, effect on airplane flight in Africa, 155
- Amazon Basin
 NW-Amazonien: Ein Beitrag zur Geographie Äquatorial-Amerikas (Bauer), *rev.*, 72
- America
 Old World and, 205
- American Association for the Advancement of Science, 144
- American Geographers. *See* Association of American Geographers
- American Geographical Society
 Annual meeting and reports, Jan. 20; 1920, *note*, 65
 April meetings, *note*, 357
 Council's annual report, *note*, 65
 Cullum medal awards and presentation, *note*, 64, 66
 Daly medal presentation, *note*, 357
 February meetings, *note*, 141
Geographical Review, *note*, 360
 Lecturers, *note*, 64, 141, 208, 357
 March meetings, *note*, 208
 November, December, and January meetings, *note*, 64
 Officers elected, Jan. 20, 1920, *note*, 67
 Special committee's report, *note*, 66
 Treasurer's report for 1919, *note*, 66
- American Meteorological Society, 139
 Organization, officers, and committees, *note*, 144
- Ammassalik, *note*, 210
- Amoy, 317, 318
- Anhsi, 243
- Antela, 113, 122
- Anthropogeography
 Eskimo, 125
- Anthropology
 American school, method, 126
- Antiglia, 111, 112, 113
- Antilles, 109
 Name, 109
See also Antillia
- Antillia, 117
 Antillia and the Antilles (with maps) (Babcock), 109-125
 Derivation, 111
 Identifications, 110
 Of the mainland, 111
- Antioch, 79, 94, 98, 100
- Antiquities
 Lop Desert, 2, 12, 15, 17, 19
- Antung, 332
- 'Anz, Syria (ill.), 93
- Appalachia, 271
- Aquatic biological resources, Our (with ill.) (Shelford), 250-263
- Aquatic plants, 256
- Arabia, 77
- Arabs
 Chinese trade in the Middle Ages, 307
 Dragons and, 112
 In Syria, 104, 106
- Aramaic dialects, 80
- Archer, William
 India and the Future, *rev.*, 74

- Architecture
 Mesopotamian domestic (with ill.), 86
 Syrian ruins, 82, 84 (ills.), 85 (ills.), 92, 93, 99
- Arctic
 American, showing Eskimo habitat and migration routes (maps), 130, 131
 Arctic geography and Eskimo culture: A review of Steensby's work (with maps) (Wissler), 125-138
 Cruise of the *Corwin*, The (Muir), *rev.*, 148
 Peary: An appreciation (with ill.) (Bridgman), 161-169
 Tides, 168
- Arctic Archipelago, 128
 Arctic Highlanders, *note*, 142
- Argentina
 Cotton growing, 48
- Aristotle's treatise on meteorology, *rev.*, 76
- Asia
 New Map of Asia (1900-1919), The (Gibbons), *rev.*, 145
- Asmaida, 335
 Asmayda, 335
- Association of American Geographers
 St. Louis meeting, Dec. 30, 1919, to Jan. 1, 1920, 139-140
- Atlantis, 111
- Atlas of Sweden showing population distribution, *note*, 360
- Atmosphere
 Average Free-Air Conditions... at Drexel Aerological Station (Gregg), *rev.*, 372
 Conditions affecting health, *note*, 362
- Atwood, W. W., 140
- Audincourt, 58
- Australia, Labour and Industry in (Coghlan), *rev.*, 366
- Austria, Balkan commerce, 290
- Austria-Hungary, Balkan commerce, 287, 288
- Aviation
 Trans-African flight, The recent, and its lesson (with map and ills.) (Walmsley), 149-160
See also Airplanes
- Azores, 110, 345
- B**
- Babcock, W. H.
 Antillia and the Antilles (with maps), 109-124
 Mayda, The problem of, an island appearing on medieval maps (with maps), 335-346
- Baffin Island, *note*, 142
- Bahamas, 118, 123, 124
- Baker, O. E. *See* Finch, V. C., and O. E. Baker
- Balkan Peninsula
 Climatic zones (map), 204
- Balkan Peninsula (*continued*)
 Natural regions (map), *opp.* 204
 Natural regions, The, of the Balkan Peninsula (after Cvijić) (with maps), 199-204
 Pre-war commerce, The, and the commercial approaches of the Balkan Peninsula (with maps and diagrs.) (Day), 277-298
- Baltzer, F.
 Die Kolonialbahnen, mit besonderer Berücksichtigung Afrikas, *rev.*, 147
- Ranks, E. J., 357
- Baobab trees (ill.), 157
- Baradaeus, Jacobus, 106
- Barber's (C. D. A.) "Military Map Reading," etc., 60
- Barker, J. E.
 Economic Statesmanship, *rev.*, 213
- Barrell, Joseph
 Sources and Tendencies in American Geology, *rev.*, 220
- Barren Grounds, 126, 127, 128, 134, 136, 138
- Battle Harbor, 162
- Bauer, P. P.
 NW-Amazonen: Ein Beitrag zur Geographie Äquatorial-Amerikas, *rev.*, 72
- Beccario map of 1426
 Antillia on, 114
- Beccario map of 1435
 Antillia on, 115
 Section in facsimile showing Antillia, etc. (map), 116
- Bedouins, 86, 92, 107
 Christian, Syria, 107 (ill.), 108
- Behaim, 109
- Beimini (Bimini), 110
- Belfort, Gate of, 52, 53, 57
- Benincasa map of 1482
 Antillia on, 115, 121
 Section in facsimile showing Antillia, etc. (map), 121
- Bernese Jura, 53
- Besançon, 52, 54
- Bianco map of 1436
 Antillia on, 115, 118
- Bibliography
 Note on future method of publication in the *Review*, 76
- Bimini (Beimini), 110
- Biological resources, Our aquatic (with ills.) (Shelford), 250-265
- Birds and water courses, 255
- Bison, Eskimo culture and, 129, 137
- Blair, T. A., 208
- Bland, J. O. P., 186
- Boas, Franz, 127
 Quoted on ice conditions and Eskimo habits, 132
- Boerker, R. H. D.
 Our National Forests, *rev.*, 220
- Bohain, the naturalist, 58
- Bolivia
 Cotton growing, 48

OUR CONTRIBUTORS

Sir Aurel Stein is an eminent British archeologist and explorer, one of the foremost authorities on the early relations between China and the Western world. His investigations in this field were made chiefly on three expeditions to Chinese Turkestan, in 1900-01, 1906-08, and 1913-16. The present article deals with a part of the last journey. Of each of the first two journeys he has published popular and scientific accounts, as follows: first journey, "Sand-Buried Ruins of Khotan" (1903), and "Preliminary Report on a Journey of Archaeological and Topographical Exploration in Chinese Turkestan" (1901) and "Ancient Khotan" (1 vol. text, 1 vol. plates, 1907); second journey, "Ruins of Desert Cathay" (2 vols., 1912) and "Serindia" (in press). A preliminary account of the third journey appeared in the *Geographical Journal* for August and September, 1916.

Mr. McBride, lately librarian of the Society and an assistant editor of the *Review*, is intimately familiar with Latin-American conditions from a sojourn of several years in Bolivia and Chile. He is at present engaged in social welfare work in Mexico City. He has written "The Galápagos Islands" (*Geogr. Rev.*, Sept., 1918) and "Cotton and Human Affairs" (*Journ. of Geogr.*, March, 1920).

Pierre Chavannes is the *nom de plume* of Léon Marchand, a French author, native of Montbéliard.

Dr. Johnson is professor of physiography at Columbia University. In addition to numerous physiographical papers he has written "Shore Processes and Shoreline Development" (1919) and edited Professor W. M. Davis' "Geographical Essays" (1909). As major in the army he served as chief of the Division of Boundary Geography and member of several territorial commissions at the peace conference. In the domain of military geography he has written "Topography and Strategy in the War" (1917), an expanded reprint of articles that appeared in the *Bulletin of the American Geographical Society*, 1915, and the *Geographical Review*, 1916 and 1917.

THE GEOGRAPHICAL REVIEW

CONTENTS FOR JANUARY, 1920

Explorations in the Lop Desert. By Sir Aurel Stein. (1 map, 12 photos)	I
Cotton Growing in South America. By George McCutcheon McBride. (1 map, 4 photos)	35
The Pays de Montbéliard. By Pierre Chavannes. (1 map)	51
Some Recent Books on Military Geography. By Douglas W. Johnson	60
Geographical Record	64

<i>American Geographical Society</i>	
Meetings of November, December, and January	64
Presentation of the Cullum Geographical Medal to Professor Henry Fairfield Osborn	64
Annual Reports of the Society	65

<i>North America</i>	
Snow and the Railroads	67
A New Series of Rainfall Maps for the United States	67

<i>Africa</i>	
Projected Railways Across the Sahara	68

<i>Asia</i>	
Two Interesting Maps of Syria	69
Wasteful Exploitation of Manchurian Forests	69

<i>Geographical News</i>	
Obituary	69

Geographical Reviews	70
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ERRATA

- p. 1, last two lines: *to words "an important trade route," add footnote as follows: See Albert Herrmann: Die alten Seidenstrassen zwischen China und Syrien, with map. 1: 5,000,000, Quellen und Forsch. zur alten Geschichte und Geogr., Heft 21, Berlin, 1910; idem: Zur alten Geographie Zentralasiens, with same map, Petermanns Mitt., Vol. 57, 1911, Part 1, pp. 12-15.*
- p. 11, line 7: *for guilding read guiding.*
- p. 12, line 3: *for west-northwest read west-southwest.*
- p. 35, line 15: *read as follows: be extended so that the dangers of dependence on restricted sources of*
- p. 45, line 7: *for rainfall read rainfall.*
- p. 69, line 9: *add the following references on the mosaic map of Madaba: Beazley's "Dawn of Modern Geography," Vol. 2, London, 1901, pp. 580-583 and 633-636, with reproduction facing p. 580; Konrad Miller: Rekonstruierte Karten (Heft VI of his "Mappaemundi: Die ältesten Weltkarten"), Stuttgart, 1898, pp. 148-154 and Figs. 54-58.*
- p. 147, line 5 from bottom: *precede title with G. M. Allen, edit.*
- p. 223, line 3: *for Hsia-tien-ti-e-mên read Tien-hsia-ti-e-mên.*
- p. 237, re line 7 from bottom: *Ningsiafu was not visited by Mr. Clapp, but by Mr. M. L. Fuller, another member of the party.*
- p. 290, line 9: *for the basis read this basis.*
- p. 296, next-to-last line of footnote 11: *for Einfluss read Einfluss.*
- p. 297, col. 2 of table, line 2: *for 66.2 read 66.3*
- p. 298, last line of footnote 13: *for blished read published.*

ADDITIONAL ERRATA IN PREVIOUS VOLUMES

Vol. I

- p. 50, lines 10 and 19 from bottom and p. 171, map, lat. 12°S., long. 60°W.: *for Cardoso read Cardoso.*

Vol. III

- p. 153, signature of first note: *for William Gardner Reed read William Gardiner Reed.*

Vol. IV

- p. 523, col. 1: *for Hermesson, J. L., read Hermessen, J. L.*

Vol. V

- p. 87, line 2 of review of Goode's wall maps: *for 5000-foot is contour read 5000-foot contour is.*
- p. 146, line 2: *for countries read counties.*
- p. 325, line 3: *for Society's read Societies'.*
- p. 511, line 25: *for Allgemeiner read Allgemeiner.*
- p. 528, col. 1, line 28 from bottom: *for Moroccan read Moroccan.*
- p. 546, col. 1, line 15 from bottom: *for Plant or read Plant on.*
- p. 554, col. 1, line 21 from bottom: *for Veedeer read Veedeer.*
- p. 556, col. 1: *for Whitbeck, W. H. read Whitbeck, R. H.*

Vol. VI

- pp. 59 and 61, last line of table: *for Total read Average.*
- p. 172, line 19 from bottom: *for sur read zur.*
- p. 293, line 1 of fourth entry should read:— *United States Geological Survey, Topographic Instructions of.*
- p. 373, line 27, and p. 533, col. 2, sixth entry: *for G. St. J. Orde Brown read G. St. J. Orde Browne.*
- p. 381, last line: *for equitable read equable*
- p. 430, line 1: *for which read with.*
- p. 524, line 12 from bottom: *for -64.2°F. read -74.2°F.*
- p. 524, line 13 from bottom: *for 24°C. read -24°C.*
- p. 543, col. 2, line 8 from bottom: *for derlig read dertig.*

Vol. VII

- p. 55, line 2 of title under South America: *for Ernest Vohsen read Ernst Vohsen.*
- p. 268, line 14: *for 100 square miles read 100,000 square miles.*
- p. 273, line 22 from bottom: *for dans des Alpes read dans les Alpes.*
- p. 391, Table II, next-to-last column, line 3: *for 0.01 mm read 00.1"*
- p. 431, line 12: *for Mr. Bell's read Mr. Fell's.*

Vol. VIII

- p. 290, line 5: *the phrase as Matthew suggests should apply only to the location of the biological center in Asia and not to the causation of race migrations by climatic thrusts.*
- p. 301, line 15 from bottom: *for 65° or 80° read 65° or 70°.*
- p. 306, Table I, column "Malaya": *for Mysore read Misore (East Indian island off New Guinea) and for Sikai of Flores read Sika of Flores.*
- p. 308, line 4 from bottom: *for Riss glaciation read Würm glaciation.*
- p. 308, " 5 " " " *for Second Glacial Age read Third Glacial Age.*
- p. 315, Fig. 11 title of first half of diagram: *for Lower Cambrian read later (or upper) Cambrian.*
- p. 383, col. 2, line 17: *for Sahura-jima read Sakura-jima.*
- p. 400, col. 2, line 2: *for Nerobigin read Newbigin.*

- Watchtowers. *See* Towers
 Water
 Civilization dependent on, 250
 Pollution and purification, 260
 Waterspouts, 217
 Weather
 Mesopotamia, *note*, 361
 Ohio and winter-wheat yield, *note*, 208
Weds, 211
 Wegener, Alfred
 Wind- und Wasserhosen in Europa, *rev.*, 217
 Weihaiwei, 314
 Weimar map (anon.; Freducci?), 114
 Antillia on, 122
 Wenchow, 318, 319
 Werribee River
 Physiography, The, of the Werribee River Area (Fenner), *rev.*, 146
 West, F. J., 140
 Whale Sound, 166
 Wheat, 184
 Weather and winter-wheat yield in Ohio, *note*, 208
 Whitbeck, R. H., 139
 St. Louis meeting of the A. A. G., 139-140
 White, David, 139
 Whitehouse, W. E., *note*, 141, 365
 Williams, E. T.
 Open ports of China, The (with map), 306-334
 Review of Parker's "China," 219
 Review of Steiner's "The Japanese Invasion," 71
 Winds. *See* Erosion
 Wine, ancient Syrian production, 100
 Wissler, Clark
 Arctic geography and Eskimo culture: A review of Steensby's work (with maps), 125-138
 Wocikof, Alexander, 353
 Wolstenholme Sound, 142
 Woosung 320
 World
 World's food resources, The (von Engel), 170-190
 World Island
 Mackinder's 'World Island' and its American "satellite" (with map) (Dryer), 205-207
 World Ring and (map), 206
 World Ring, 206
 Wunderlich, E.
 Handbuch von Polen (Kongress-Polen), *rev.*, 215
 Württemberg, 54, 55, 57
- Y**
- Yalu River, 331, 332
 Yamên, 19
 Yangtze Kiang, 323
 Yard, R. S.
 The Book of the National Parks, *rev.*, 148
Yardangs, 10 (ill.), 11, 15, 19, 24, 26
 Yellow fever in Panama, 147
 Yellow race, 189
 Yenchí, 332
 Yen-sun, Ho, 221
 Yochow, 314, 325
 Yokota, Tokezo. *See* Terada, Torahiko, Tokezo Yokota, and Syohu Otuki
 York, Cape, Eskimos, *note*, 143
 Young, C. H., 64
 Yülinfu, 234, 235
 City panorama (ill.), 244
- Z**
- Zagora, 203
 Zayton, 313
 Zeppelins, 159

- Tientsin, 329
 Tikenlik, 6
 Timber
 Manchuria, *note*, 69
Toghraks, 12, 15, 23
 Tombs
 Ruin at Dâṇā, Syria (ill.), 85
 Syria, ruins, 83
 Tonkin, 312
 Tornadoes
 Wind- und Wasserhosen in Europa
 (Wegener), *rev.*, 217
 Toscanelli, 109, 110
 Towers
 "First Frontier Wall" of China seen
 from ruined tower (ill.), 242
 In "First Frontier Wall" of China (ill.),
 240
 Watchtower, ancient Chinese, 27
 Watchtower at Sihai (ill.), 231
 Watchtowers on the Great Wall of China,
 227, 248
 Trade. *See* Commerce
 Transhumance, 203
 Transportation
 Costs, and food production, 174
 Travel
 Handbook of Travel, *rev.*, 147
 Trees
 Baobab (ill.), 157
 Mangrove (ill.), 153
 Stream margins in Indiana and Illinois
 (ills.), 257
 Tropical, seen from airplane (ills.), 153,
 158
 Tropics
 Problem, 190
 Weather and airplane flight in Africa, 156
 Tsingtao, 313, 326
 Tübingen, 56, 58
 Tucker, W. M., 140
 Tungting Lake, 314, 325
 Tun-huang, 2, 5, 21, 26, 30, 34
 Turkey
 Commerce statistics, 277
 Turner, H. H., 76
 Turtles, 255
 Tushihkow, 227
 "Twenty-one Demands," 315, 326, 327

U

- Umiak, 133
 Umm idj-Djimal, Syria, 90 (ill.), 92
 Umm il-Kuttân, Syria (ill.), 95
 "Union and penetration," 199
 United States
 Cloudiness, mean annual (map), 348
 Cloudiness in the United States (with
 map and diags.) (Ward), 347-356
 Japanese Invasion, The: A Study in the
 Psychology of Inter-Racial Contacts
 (Steiner), *rev.*, 71
 Rainfall maps, new series, *note*, 67
 Strategic position, 63

- U. S. Geological Survey
 Award of Daly medal to Director, *note*
 357, 358
 U. S. Immigration Commission, 70
 U. S. Weather Bureau, *note*, 364
 Urga, 312
 Uruguay
 Cotton growing, 50

V

- Valleys
 Finger Lakes in New York state (map),
 273
 Valsequa map of 1439, 123
 Van Cleef, Eugene
 Review of Finch and Baker's "Geog-
 raphy of the World's Agriculture," 74
 Vardar Region, 203
 Vaughan, T. W.
 Corals and the Formation of Coral Reefs,
 rev., 370
 Vegetation
 Water margin in Indiana and Illinois
 (ills.), 257
 Venezuela
 Cotton growing, 49
 Verhoeff, J. M., 166
 Vesontis. *See* Besançon
 Vestal, A. G., 140
 Villages
 African village seen from airplane (ill.),
 158
 Visser, S. S., 140
 Vital statistics, 187
 Vitamines, 184
 Vlaenderen, 344
 Ortelius maps of 1570 showing (map).
 343
Voortrekker (airplane), 150
 Vosges Mountains, 51

W

- Wādī il-'Akīb, Syria, 88, 89 (ill.)
 Wādī Zēdī, Syria, 101
 Wales
 Relief model, *note*, 141-142, 365
 Wall, Chinese. *See* Great Wall of China.
 Walmsley, Leo
 The recent trans-African flight and its
 lesson (with map and ills.), 149-160
 War, the
 After-the-war problems, 213
 Food and, 178
 Ward, R. DeC., *note*, 364
 Cloudiness in the United States (with
 maps and diags.), 347-356
 New series of rainfall maps for the
 United States, *note*, 67
 Review of Aristotle's treatise on me-
 teorology, 76
 Review of Wegener's "Wind- und Wasser-
 hosen in Europa," 217
 Snow and the railroads, *note*, 67

- Shōr*, 9, 25, 29, 30
Shota, 9
 Shrubbery, 258
 Shumadiya Region, 202
 Siberia, 128
 Sihai, 224, 227
 Old watchtower at (ill.), 231
Silver Queen (airplane), 150
 Simkhār, Syria (ill.), 81
 Singewald, J. T., Jr. *See* Miller, B. L., and
 J. T. Singewald, Jr.
 Skoplye (Üsküb), 202, 203
 Smith, George Otis
 Daly medal presentation and addresses,
 note, 357, 358
 Smith, J. Russell, on the world's food re-
 sources, 170
 Smith, J. Warren, 140, 141 (*note*)
 Smith, Ross, 149
 Snow and railroads, *note*, 67
 Snow sheds, *note*, 67
 Snowfall
 Mt. Rainier, *note*, 209
 Sofia, Treaty of, 1915, 304
 Soldiers
 Land, The, and the Soldier (Howe), *rev.*,
 214
Solovye Budomirovich (ship), 361, 362
 Soochow, 319, 320, 322
 South America
 Cotton growing in (with map and ills.)
 (McBride), 35-50
 Cotton producing areas (map), 36
 Mineral Deposits, The, of South America
 (Miller and Singewald), *rev.*, 216
 Southern Pacific Railroad, *note*, 67
 Sowerby, A. de C., 69
 Spitsbergen
 Letter from R. N. Rudmose Brown to
 the *Geogr. Rev.*, 372
 Norwegian surveys, *note*, 210
 Standards of living, 175
Statistical Bulletin, *note*, 208
 Steensby, H. P., 143
 Review of his work on Eskimo culture, 125
 Stefánsson, Vilhjálmur, quoted on shellfish
 as Eskimo food, 133
 Stein, Sir Aurel, 242
 Explorations in the Lop Desert (with map
 and ills.), 1-34
 Party on exploring trip in Lop Desert, 8,
 29 (ill.)
 Steiner, J. F.
 The Japanese Invasion: A Study in the
 Psychology of Inter-Racial Contacts,
 rev., 71
 Stevenson, E. L., 118
 Storms. *See* Meteorology; Thunderstorms;
 Tornadoes
 Strategic geography, 62
 Streams
 Pollution, 252, 260
 Stuart's (E. R.) "Map Reading and Topo-
 graphical Sketching," 60
 Stuck, Hudson, *note*, 141
 S. A. T. C. textbook, 61
Stupa, 6, 7, 18
 Suchow, 239
Sudd country, 154
 Sulo Ho, 243
 Sungari River, 69
 Survey of India, note on topographic maps,
 76
 Surveys in Spitsbergen, *note*, 210
 Sverdrup, Otto, 362
Sviatogor (ship), 362
 Swamps, 256
 Swatow, 317
 Sweden
 Atlas of population distribution, *note*, 360
 Syria
 Ancient—4th-6th centuries (map by But-
 ler), opp. 108
 Ancient inhabitants, 98
 Desert Syria, the land of a lost civiliza-
 tion (with maps and ills.) (Butler),
 77-108
 Expeditions, 104
 Maps, two interesting, *note*, 69
 Present inhabitants, 105
 Roman roads according to Tabula Pen-
 tingeriana, with geographical adjust-
 ment (ill. and map), 96, 97
 Syriac language, 80, 99
- T
- Tabula Peutingeriana, 93
 Section showing Syria, reproduction, with
 geographical adjustment (ill. and
 map), 96, 97
 Takla-makan Desert, 2, 9, 15
 Taku, 329
 Tangier, 68
 Tarim River, 1, 9, 18
 Teachers. *See* National Council of Geog-
 raphy Teachers
 Teggart, F. J., 205
 Review of Branford and Geddes, "The
 Coming Polity," 366
 Teisserenc de Bort, Léon, 349
 Terada, Torahiko, Tokezo Yokota, and
 Syohu Otuki
 On the Distribution of Cyclonic Precipi-
 tation in Japan, *rev.*, 218
 Terrible, Mont, 51, 53
 Thalbitzer, William, 127
 Thompson, B. F.
 History of Long Island, etc., *rev.*, 219
 Thule, 142
 Thunderstorms
 Panama, *note*, 141
 Tibet
 Commerce, 312, 315
 On the Eaves of the World (Farrer), *rev.*,
 218
 Tibetan Loop (of the Great Wall), 238
 Tides
 Peary's observations, 168

Rainfall (*continued*)

- Maximum floods, *note*, 212
- On the Distribution of Cyclonic Precipitation in Japan (Terada and others), *rev.*, 218
- Secular Variation of Rainfall, The (Brooks), *rev.*, 371
- United States, new maps, *note*, 67
- Rainier, Mt.
- Snowfall, *note*, 209
- Rashka Region, 202
- Rasmussen, Knud, 137
- Completion of his study of Greenland Eskimos, *note*, 210
- Red Cliff House, 166
- Reformation, Protestant, 55

Regions

- Balkan Peninsula (map), *opp.* 204
- Natural regions, The, of the Balkan Peninsula (after Cvijić) (with maps), 199-204

Reindeer, American culture, 136

Relief model of Wales, *note*, 141-142, 365

Revelière, Comte de la

- Les énergies françaises au Maroc: Études économiques et sociales, *rev.*, 73

Reviews of geographical publications, 70, 145, 213, 366

Reylla, 115, 117, 118, 119, 120, 121, 122

Ridley, H. F., 238-239

Rink, H., 127, 128

Rivers

- African meanders, seen from airplane (ills.), 152
- Damming, 253
- Margin vegetation in Indiana and Illinois (ills.), 257

Roads

- Ancient Roman, in Syria, 93
- Ancient Roman, in Syria, according to Tabula Peutingeriana, with geographical adjustment (ill. and map), 96, 97
- Ancient Roman, in Syria, between Antioch and Chalcis (ill.), 98
- Ancient Roman construction, new light, 95

Robertson, D. H.

- A Study of Industrial Fluctuation, *rev.*, 214

Rochereau, Denfert, 57

Roorbach, G. B., 172, 183

Roosevelt (ship), 166

Roselli map of 1468

- Antillia on, 115, 118

Rousseau, J. J., 55

Rufiji River

- Mouth, seen from airplane (ill.), 152

Rug map of Syria, *note*, 69

Ruins

- Lop Desert, 4 (ill.), 6 (ill.), 7 (ill.), 10 (ill.), 12, 13 (ills.)
- Syria, 80

Rumania

- Commercial statistics, 278

Rusâfâ, 94

Russia

- Overland trade with China, 311

Russo-Japanese War, 314

Ryneveld, P. van, 150, 156, 157

S

Sahara

- Algerian, and Libyan Desert, *note*, 211

- Projected railways, *note*, 68

St. Louis

- Meeting of the Association of American Geographers, 139

St. Simeon Stylites

- Ruined inn on road to shrine, Syria (ill.), 85

- Ruined monastery and church, Syria (ill.), 82

Salisbury, R. D., 167

Salmon, 254

Salmond, W. G. H., 149

Salvages (islands), 117

Salvagio, 115, 117, 118, 119, 121, 122

Sand dunes, *See* Dunes

Sanders, E. M.

- Projected railways across the Sahara, *note*, 68

Sanitation

- Panama Canal, 197

- Sanitation in Panama (Gorgas), *rev.*, 147

Santuaio, 317, 318

São Joaquim, Brazil

- Cotton trees (ill.), 41

São Paulo (state)

- Cotton growing, 45

- Cotton picking (ill.), 40

Satanaxio, 119

Sauer, C. O., 140

Schuller manuscripts, 111, 112, 113

Seals and Eskimo culture, 129, 132

Serakib, Syria (ill.), 86

Serb-Croat-Slovene State, 299

Serbia

- Commercial statistics, 278

Serdjibleh, Syria (ill.), 78

Serdjillâ, Syria (ill.), 81

Sewage, 252, 260

Shad, 253

Shamal, 361

Shanghai, 320, 321

Shanhaikwan, 221, 224, 225

- Beginning of Great Wall near (ill.), 224

- Eastern gate (ill.), 225

Shansi, 230, 247

Shantung, 309, 313, 326

- Japan's entrance, 327

- Railway, 328

Shasi, 323

Shêkh Slêman, Syria (ill.), 83

Shelford, V. E.

- Our aquatic biological resources (with ills.), 250-263

Shensi, 234, 247, 249

Shimonoseki

- Treaty of, 312, 313

- Ooqueah (Eskimo), 165
 "Open door" policy, 314
 Orbolunda, 342
 Ordos Desert, 234, 235
 Changlopu being buried by sand (ill.), 241
 Dunes (ill.), 237
 "First Frontier Wall" towers rising from buried wall (ill.), 240
 Orontes River, 80, 94, 105
 Ortelius map of 1570
 Vlaenderen and Brazil (island) on (map), 343
 Osborn, H. F.
 Cullum medal award and presentation, *note*, 64, 66
 Otuki, Syohu. *See* Terada, Torahiko, Tokezo Yokota, and Syohu Otuki
- P**
- Paleo-Eskimos, 126, 135, 137
 Palmer, A. H., 67
 Palmyra, 94
 Panama
 Sanitation in Panama (Gorgas), *rev.*, 147
 Thunderstorms, *note*, 141
 Panama Canal, 63
 Five years of the Panama Canal: An evaluation (Brown), 191-198
 Paradise Inn, Wash., 209
 Paraguay
 Cotton growing, 48
 Parbury, Florence, 64
 Pareto map of 1455
 Antillia on, 115, 119
 Section reproduced showing Antillia (map), 120
 Parker, E. H.
 China: Her History, Diplomacy, and Commerce, etc., *rev.*, 219
 Parks
 Book of the National Parks, The (Yard), *rev.*, 148
 Patriarchy among the Druses, 107
 Peary, R. E.
 Peary: An appreciation (with ill.) (Bridgman), 161-169
 Portrait, 163
 Tidal observations, 168
 Pei Shan, 223
 Peking
 Russian trade, 311
 Persian invasion of Syria in 610-612, 79, 101
 Peru
 Cotton growing, 37
 Peter Martyr, 109
 Physiography
 Geomorphological Studies in Norway (Ahlmann), *rev.*, 368
 Phytogeography
 Studien über die Moore Finnlands (Cajander), *rev.*, 369
 Pindus Region, 203
 Piracicaba Agricultural School (ill.), 40
 Piseo, 38, 39, 43
 Piura, 38
 Pizigani map of 1367
 Mayda and Brazil (island) on (map), 338
 Planina, 203
 Plants
 Aquatic, 256
 Plasticine, *note*, 142
 Poland
 Handbuch von Polen (Kongress-Polen) (Wunderlich), *rev.*, 215
 Polar exploration
 Peary and, 161
 Political geography
 Asia, The New Map of, (1900-1919) (Gibbons), *rev.*, 145
 Coming Polity, The: A Study in Reconstruction (Branford and Geddes), *rev.*, 366
 Polye, 203
 Pond's Inlet, *note*, 142
 Population
 Checking increase, 186
 Increase, and food, 177
 Macedonia, distribution in southern, *note*, 209
 Sweden, atlas of distribution, *note*, 360
 Port Arthur, 313, 314, 332
 Ports
 China, anomalous condition of open ports, 334
 China, classes of open ports, 333
 China; The open ports of (with map) (Williams), 306-334
 Portugal, 114, 124
 Trade with China, 309
 Posey, C. J., 140
 Pottery
 China, 325
 Poyang Lake, 325
 Precipitation. *See* Rainfall
 Primorye, 203
 Production, food, 172
 Prohibition, release of land by, 186
 Protestantism, 55
 Prunes map of 1553
 Mayda on (map), 341
 Ptolemy map of 1513
 Mayda and Brazil (island) on (map), 336
- R**
- Rabot, Charles, *note*, 372
 Race preservation, 187
 Railroads
 Kolonialbahnen, Die, mit besonderer Berücksichtigung Afrikas (Baltzer). *rev.*, 147
 Sahara projects, *note*, 68
 Snow and, *note*, 67
 Rainfall
 Cloudiness and, 356
 Cultivation and, *note*, 141
 Forests and, Syrian desert, 103

Migrations

Eskimo, recent, *note*, 142

Eskimo, routes in American Arctic (maps), 130, 131

Military geography

Some recent books on military geography (Johnson), 60-63

Miller, B. L., and J. T. Singewald, Jr.

The Mineral Deposits of South America, *rev.*, 216

Miller, G. J., 140

Minas Geraes

Cotton field (ill.), 40

Cotton growing, 44

Minerals

South America, The Mineral Deposits of (Miller and Singewald), *rev.*, 216

Miran, 2, 14

Stein exploring party (ill.), 29

Mississippi River

Fisheries, 254

Mohawk Valley, 269

Mollweide map, 206

Monasteries

St. Simeon Stylites, Syria (ill.), 82

Umm il-Kuttân, Syria (ill.), 95

Mongalia, 150, 157

Mongolia, 228

Carts hauling stores to (ill.), 233

Commerce, 311-312

Monthéliard

Features and development of the *pays* (map), 53

Pays of, The (with map) (Obavannes), 51-59

Moors

Studien über die Moore Finnlands (Cajander), *rev.*, 369

Morava-Vardar Region, 202

Moreno, F. P., obituary, 69

Morocco

Énergies françaises, Les, au Maroc: études économiques et sociales (Revelière), *rev.*, 73

Mosaic map of Syria, *note*, 69

Mounds

"White dragon," 30

Mount. *See* name of mountain

Muir, John

The Cruise of the Corwin, *rev.*, 148

Mukden, 332

Mummy in Lop Desert, 23

Musk oxen

As basis of Eskimo culture, 128, 134, 137

Habitat in American Arctic (map), 130

Mussels, 252, 253, 254

N

Nabataean kingdom, 79

Nabataean language, 80

Nahr il-Kelb, Syria, 94-95

Nanking, 312, 320, 322

Treaty of, 310

Nankow, 231, 232

Nankow Pass, 224, 247, 248

Great Wall of China at (ills.), 222, 235

Steps and method of construction of Great Wall (ills.), 246, 247

Nanning, 314, 316

National Council of Geography Teachers, 139

National forests. *See under* Forests

National Museum of Wales, *note*, 141

National parks. *See* Parks

Negra's Rock, 344, 345

Negroes, 189

Neo-Eskimos, 126, 135

Neuilly, 299

New England

Cloudiness, 352

New York (state)

Western lowland topography, 264

Newchwang, 331

News. *See* Geographical news

Niagara Cuesta, The, from a new viewpoint (with maps and diags.) (Grabau), 264-276

Nicolay map of 1560

Mayda and Brazil (island) on (map), 342

Nigeria, 68

Ningpo, 318, 319

Ningsiafu, 237

Nish, 202

Nordenskiöld, A. E., on the Antilles, 109

Normand, C. W. B., *note*, 361

North Star Bay, 142

Norway

Geomorphological Studies in Norway (Ahlmann), *rev.*, 368

Population and food, 184

Norwegians

Spitsbergen surveys, *note*, 210

Nyasa, Lake

Landing an airplane hangar (ill.), 155

O

Oases

Shêkh Slêman, Syria, 82, 83 (ill.)

Yülinfu, 235

Obituary

Chapman, R. H., 365

Moreno, F. P., 69

Occurrence, 205

Ogilvie, A. G., 209

Ohio

Weather and winter-wheat yield, *note*, 208

Oil, olive, ancient Syrian production, 100

Okefinokee Swamp, 257

Old World and New World, relation, 205

Ommayads, 104

Oneida Lake, 255

Onondaga Cuesta, 268, 270

Ontario, Lake

Cuestas of the region, 267

Ontario Dome, 272

Ontario Dome region, restoration of Tertiary drainage (maps), 275, 276

- Laon globe of 1493, 113, 122
 Lauck, W. J. *See* Jenks, J. W., and W. J. Lauck
 Laurentian Oldland, 275, 276
 Lava at Ledjā, Syria, 88, 89 (ill.)
 Ledjā, Syria, 87, 88, 107
 Lava field, 88, 89 (ill.)
 Li, 221
 Liangchowfu, 238
 Liaotung, Gulf of, 221, 224
 Libyan Desert and Algerian Sahara, *note*, 211
 Livingstone, South Africa, 150, 154, 157, 159
 Loess, 228, 247
 Road worn down in, China (ill.), 236
 Lomont, Montagnes de, 51
 London Times, 149
 Long Island
 History of Long Island, etc. (Thompson), *rev.*, 219
 Longstroth, T. M.
 The Catskills, *rev.*, 368
 Lop Desert
 Explorations in the Lop Desert (with map and ills.) (Stein), 1-34
 Explorations of Sir Aurel Stein (map), 3
 Lop Lake
 Ancient bed, 16 (ills.), 20 (ill.), 21 (ill.)
 Bed, 16 (ills.), 31, 32
 Lopliks, 2, 6, 8, 23
 Lou-lan, 3
 Explorations near, 19
 Ruined dwelling (ill.), 7
 Ruined fort southwest of (ill.), 4
 Ruined stupa, or shrine (ill.), 6
 Wind-eroded clay ridge northeast of (ill.), 13
 Wind-eroded ridges (ill.), 10
 Lunnholtz, Carl, *note*, 141
- M**
- Macao, 309, 316
 McBride, G. M.
 Cotton growing in South America (with map and ills.), 35-50
 Maccabean kingdom, 79
 McClintock, F. L., 144
 McCollum, E. V., 184
 McCormick Bay, 165, 166
 Macedonia
 Southern, distribution of population, *note*, 209
 Machinery and food, 181
 Mackinder, H. J.
 Mackinder's 'World Island' and its American "satellite" (with map) (Dryer), 205-207
 McKoy, K. T., 221
 Maida, 335
 Mallet, Sir Bernard, 187
 Man (island), 336, 337, 339, 345
 Manchuria, 313, 330
 Forest exploitation, *note*, 69
 Manchuria (*continued*)
 Railways, 331
 Mandure, 52
 Mangroves
 Seen from airplane (ill.), 153
 "Map Reading and Panorama Sketching," 60
 Maps
 Antillia and the Antilles (with maps) (Babeck), 109-124
 Mollweide's projection (ill.), 206
 Problem of Mayda, The, an island appearing on medieval maps (with maps) (Babeck), 335-346
 Rainfall, United States, new series, *note*, 67
 Syria, mosaic and rug, *note*, 69
 Wales, relief model, *note*, 141
 Maranhão (state)
 Cotton farm (ill.), 41
 Cotton production, 45
 Marco Polo, 239, 318, 319
 Margary, A. R., 312
 Maritsa Basin, 201
 Marketing, 185
 Martyr, Peter, 109
 Mauro (Fra) map of 1459, 123
 Mayd, 335
 Mayda
 Catalan map of 1375 showing (map), 340
 Nicolay map of 1560 showing (map), 342
 Pizigani map of 1367 showing (map), 338
 Problem of Mayda, The, an island appearing on medieval maps (with maps) (Babeck), 335-346
 Prunes map of 1553 showing (map), 341
 Ptolemy map of 1513, showing (map), 336
 Mayde, 335
 Meanders
 African river, seen from airplane (ill.), 152
 Melbourne
 Physiography of a region near, 146
 Merkrosuak, *note*, 142, 143
 Meshas
 Lop Desert, 22, 23, 25 (ill.), 26, 27, 34
 Mesopotamia
 Climate and weather, *note*, 361
 Mesopotamian architecture (with ill.), 86
 Meteorology
 Aristotelis meteorologicorum libri quatuor, *rev.*, 76
 Atmospheric conditions affecting health, *note*, 362
 Extension of instruction, *note*, 364
 Organization of American Meteorological Society, 139, 144 (*note*)
 Wind- und Wasserhosen in Europa (Wegener), *rev.*, 217
 See also Climate; Cloudiness; Rainfall; Weather
 Metropolitan Life Insurance Co., *note*, 208

- Indian scripts, ancient, 15, 17
 Indiana
 Stream margin vegetation (ill.), 257
 Indians, North American
 Eskimo culture in relation to Indian culture, 129, 136, 137, 138
 Industry
 Study, A, of Industrial Fluctuation (Robertson), *rev.*, 214
 Infant mortality, 188
 Inglefield Gulf, 162, 164
 Inuit language, 165
 in-Nukra plain, Syria, 88, 102, 106
 Inscriptions
 Kuoehieh Ta, 232
 Syria, 99, 100, 104
 Insula in Mar, 118, 124
 Irak, *note*, 361
 Irrigation in the Syrian desert, 102
 Isker Basin, Upper, 202
 Islands
 Antillia and the Antilles (with maps) (Babcock), 109-124
 Legendary, 345
 Mayda, The problem of, an island appearing on medieval maps (with maps) (Babcock), 335-346
 "World Island," 205
 Isonephs, 349
 "Isolation and separation," 199
 Isriyeh, Syria, 87
 is-Sâfiyeh, Syria (ill.), 92

J

- Jamaica, 117, 123, 124
 Japan
 Chinese ports and, 315
 Food situation, 184
 On the Distribution of Cyclonic Precipitation in Japan (Terada and others), *rev.*, 218
 Shantung and, 327
 Japanese
 Japanese Invasion, The: A Study in the Psychology of Inter-Racial Contacts (Steiner), *rev.*, 71
 Jeannette (ship), 148
 Jefferson, Mark
 Review of Wunderlich's "Handbuch von Polen (Kongress-Polen)," 215

- Jenghis Khan, 232
 Jenks, J. W., and W. J. Lanck
 The Immigration Problem: A Study of American Immigration Conditions and Needs, *rev.*, 70
 Jesup, M. K., 164
 Johnson, D. W.
 Some recent books on military geography, 60-63
 Jones, Wellington D., 140
 Jonzele, 339
 Jura Mountains, 51, 53, 59

K

- Kalgan, 227, 228, 312

- Kanchow, 239
 Kansu, 238, 247
 Kansu-Tibet
 On the Eaves of the World (Farrer), *rev.*, 218
 Kaolin, 325
 Kara Sea
 Drift voyage, *note*, 361
 Kasr Ibn Wardân, Syria, 87
 Kastâl Krêm, Syria (ill.), 89
 Katathermometer, *note*, 362
 Kayak, 133, 142, 143
 Keene's cement, *note*, 142
 Ketman, 8, 17
 Khan, Sher Ali, 5
 Kharâb Shems, Syria
 Ruined church (ill.), 84
 Kharoshthi, 15, 19, 22
 Khartum, 150, 154, 159
 Kiangsi, 325
 Kiangsu, 320, 322
 Kiaochow Bay
 Early mention, 309
 Seizure by Germans, 313
 Kincer, J. B., 67
 Kinsay, 319
 Kirin, 69, 332, 333
 Kinkiang, 325
 Kiungchow, 317
 Koch, Lauge, 166
 Koku Shan, 223
 Great Wall of China stretching from (ill.), 225
 Kowloon, 311, 314, 316
 Kubbch (with ill.), 86
 Kuei-ling, Wu, 221
 Kumbum, 238
 Kum-kuduk, 25, 32, 34
 Kuoehieh Ta, 232
 Kupehkw, 224
 Gate with Great Wall in background (ill.), 229
 Great Wall of China at (ill.), 226
 Kurghan, 14
 Kuruk-darya, 7, 18, 29, 33
 Kuruk-tagh, 1, 6, 24, 25, 32
 Kwangchow-wan, 314, 317
 Kwangtung, 316
 Kwenlun, 1, 11

L

- Laiibach, 203
 Lakes
 Value of resources of a small lake near a city, 262
 Lal Singh, R. B., 2, 6, 19, 24, 25, 29 (ill.), 31
 Lampaco, 309
 Lanchowfu, 238
 Land
 Land, The, and the Soldier (Howe), *rev.*, 214
 Languages
 Chinese and Sumerian, 219
 Eskimo, 127, 138

- Great Wall of China (*continued*)
 At Hsifengkow (ill.), 230
 At Kupehkow (ill.), 226
 At Nankow Pass (inner branch) (ills.), 222, 235
 Beginning (ill.), 224
 Behind a gate of Kupehkow (ill.), 229
 Construction, 245, 247
 End, 239
 Engineers, 243, 248
 "First Frontier Wall" seen from ruined tower (ill.), 242
 First Frontier Wall," towers (ill.), 240
 First gate in (at Shanhaikwan) (ill.), 225
 From Koku Shan across plain (ill.), 225
 Frontier Walls, 232, 234, 236, 237
 Gate at Hsifengkow (ill.), 227
 Inner wall, 231
 Length (statistics), 245
 Loops, 237, 238
 Map of (map), opp. 248
 Mountains along which inner branch lies (ill.), 236
 Ruins of "First Frontier Wall" (ill.), 243
 Steps and method of construction at Nankow Pass (ills.), 246, 247
 System, 242
 Greece, 200
 Commercial statistics, 278
 Greely, A. W., 349, 350
 Greenland, 164
 Eskimo culture and migration, 128, 137
 Geology, 166
 Rasmussen's study of the Eskimos, *note*, 210
 Greenough, John, 64, 66, 141, 208, 357
 Gregg, W. R.
 Average Free-Air Conditions... at Drexel Aerological Station, *rev.*, 372
 Gregory, H. E., 139
 Gregory's (H. E.) "Military Geology and Topography," 61
 Guidebooks
 France, A Handbook of Northern (Davis), *rev.*, 73
 Handbook of Travel, *rev.*, 147

H

- Haas, W. H., 140
 Haichow, 320, 322
 Hainan, 317
 Handbook of Travel, *rev.*, 147
 Hangchow, 318, 319
 Hankow, 324
 Harbin, 69, 333
 Harim, Syria, 87
 Modern village (ill.), 87
 Harshberger, J. W.
 Review of Cajander's "Studien über die Moore Finnlands", 369
 Haurân, Syria, 87, 88
 Hauwarni, 106
 Type (ill.), 102
 Health
 Atmospheric conditions affecting, *note*, 362
 Country's, *note*, 208
 "Heartland," 205
 Helderberg Escarpment, 268
 Henry, A. J., 212
 Herring, 253
 Highways. *See* Roads
 Hill, Leonard, *note*, 362
 Hinds, N. E. A.
 Review of Vaughan's "Corals and the Formation of Coral Reefs," 370
 Hoel, Adolf, *note*, 210
 Homo alpinus, 23
 Hongkong
 Cession to Great Britain, 310
 Hoover, H. C., 185
 Houses
 Domed, of mud brick, in Syria (with ill.), 86
 Howe, F. C.
 The Land and the Soldier, *rev.*, 214
 Hoyle, W. E., 141
 Hsia-tien-ti-e-mên, 223, 225
 Hsifengkow
 Gate in Great Wall at (ill.), 227
 Great Wall of China at (ill.), 230
 Hsiung-nu, 242, 246
 Huguenots, 55
 Humboldt, Alexander von, on Antillia, 111
 Hunan, 325
 Hungary
 Balkan commerce, 289
 Huntington, Ellsworth
 Climatic pulsations with reference to desert Syria, 104
 Review of Brooks's "The Secular Variation of Rainfall," 371
 Review of Gibbons's "The New Map of Asia (1900-1919)," 145
 Review of Robertson's "A Study of Industrial Fluctuation," 214
 Hupeh, 325

I

- I in Mar, 115, 118, 119, 121, 122
 Ica, 38, 39
 Ice, Arctic conditions and Eskimo culture, 132
 Ichang, 323
 Idumean kingdom, 79
 Illinois
 Stream margin vegetation (ills.), 257
 Immigration
 Immigration Problem, The: A Study of American Immigration Conditions and Needs (Jenks and Lauck), *rev.*, 70
 India
 England's treatment, 145
 India and the Future (Archer), *rev.*, 74

- Etukashoo, *note*, 142, 143, 144
 Etukashoosnak, *note*, 142, 143, 144
 Euphrates River, 77, 80, 100, 101, 106
 Europe
 Wind und Wasserhosen in Europa (Wegener), *rev.*, 217
 Expeditions
 Cruise of the Corwin, The (Muir), *rev.*, 148
 Syria, 104
 Exploration
 Desert Syria, 77
 Lop Desert (with map and ills.) (Stein), 1-34
 Polar, Peary's results, 161

F

- Fairchild, H. P.
 Review of Jenks and Lauck's "The Immigration Problem," 70
 Farrer, Reginald
 On the Eaves of the World, *rev.*, 218
 Fassig, O. L., 140, 365 (*note*)
 Fellahin, 106, 107
 Fenneman, N. M., 139
 Fenner, Charles
 The Physiography of the Werribee River Area, *rev.*, 146
 Finch, V. C., and O. E. Baker
 Geography of the World's Agriculture, *rev.*, 74
 Finger Lakes
 Arrangement of valleys in New York state (maps), 273
 Valleys, 273
 Finland
 Studien über die Moore Finnlands (Cajander), *rev.*, 369
 Fish, 251
 Fisher, L. C., 209
 Fisheries
 Marine, 252
 Resources and products, 250
 Fishways, 253
 Flaherty, R. J., 64
 Fleure, H. J., *note*, 365
 Floods
 Distribution of maximum, *note*, 212
 Florida, 110, 123, 124
 Flying. *See* Aviation
 Foochow, 317, 318
 Food
 Means of expanding supply, 171
 World's food resources, The (von Engeln), 170-190
 See also Agriculture
 Forests
 Manchuria, exploitation, *note*, 69
 Our National Forests (Boerker), *rev.*, 220
 Rainfall and, Syrian desert, 103
 Tropical, seen from airplane (ill.), 153

Formaleoni, 111

Forts

- Ancient Chinese near Lop Lake, 21
 Ruined Chinese forts in Lop Desert, 4 (ill.), 12, 13 (ills.)
 Fra Mauro map of 1459, 123
 France
 Handbook of Northern France, A (Davis), *rev.*, 73
 Montbéliard and, 51
 Freducci, Conde, 114
 Freuchen, Peter, *note*, 142
 Frogs, 255
 Fukien, 317
 Fuller, M. L., 221

G

- Gaillard Cut, 195
 Gatun Lake, 193
 Gautier, E. F., *note*, 211
 Geddes, Patrick. *See* Branford, Victor, and Patrick Geddes
 Geil, W. E., 238, 239, 245
 Genetic geography, 139
 Geographers. *See* Association of American Geographers
 Geographical news, 69, 144, 365
Geographical Review
 Notice concerning current volume, *note*, 360
 Geography Teachers. *See* National Council of Geography Teachers
 Geology and Geomorphology
 Geographic side, *note*, 358
 Geomorphological Studies in Norway (Ahlmann), *rev.*, 368
 Sources and Tendencies in American Geology (Barrell), *rev.*, 220
 Teaching, in the United States, 139
 Geonomics, 139
 Germany
 Balkan commerce, 287, 291, 294, 295
 Poland and, 215
 Gibbons, H. A.
 The New Map of Asia (1900-1919), *rev.*, 145
 Giraldi map of 1426, 123
 Gläser, Arthur, 350
 Gobi, Desert of, 230, 234, 238, 249
 Godefroy, Lieut.-Col., *note*, 68
 Gorgas, W. C.
 Sanitation in Panama, *rev.*, 147
 Grabau, A. W.
 The Niagara Cuesta from a new viewpoint (with maps and diagrs.), 264-276
 Great Britain
 After-the-war problems, 213
 Great Lakes
 Cuestas in eastern region, 267
 Drainage system in eastern region, development, 274, 275
 Great Wall of China
 Along and across the Great Wall of China (with map, diagr., and ills.) (Clapp), 221-249

D

- Dairen, 331, 332
 Dakar, 68
 Dalny, 313, 332
 Daly (Charles P.) medal
 Presentation to George O. Smith, *note*, 357
 Damascus, 106
 Dams
 Keokuk, 254
 Dānā, Syria, 94
 Danube River
 As a trade route, 293
 Danubian Plateau, 200
 Dar-es-Salaam, seen from airplane (ill.), 159
 David, T. E., 61
 Davis, W. M.
 Handbook of Northern France, A., *rev.*, 73
 Niagara Cuesta and, 264
 Review of Ahlmann's "Geomorphological Studies in Norway", 368
 Review of Bauer's "NW-Amazonien," 72
 Review of Fenner's "The Physiography of the Werribee River Area," 146
 Day, Clive
 Pre-war commerce, The, and the commercial approaches of the Balkan Peninsula (with maps and diagrs.) 277-298
 Review of Barker's "Economic Statesmanship," 213
 Dean, Frederic, 64
 De Geer, Sten, *note*, 360
 Dehydration, 182
 Déné Indian culture, 129, 137
 Deserts
 Conquests of, 234
 Desert Syria, the land of a lost civilization (with maps and ills.) (Butler), 77-108
 Erosion in Sahara and Libyan, *note*, 211
 Gobi, 230, 234, 238, 249
 Lop Desert, Explorations in the (with map and ills.) (Stein), 1-34
 Ordos, 234, 235
 Ordos, sand dunes (ill.), 237
 Desiccation
 Asia, 1
 Syria, ancient, 101
 Diadochi, 79
 Dinaric Region, 203
 Djebel Haurân, Syria, 88, 89, 91, 92, 93
 View (ill.), 88
 Djebel id-Drûz, 106
 Djsir il-Medjdal bridge, Syria, 94, 99 (ill.)
 Dodge, R. E., 139
 Dog River, Syria, 94-95
 Doubs River, 52
 Dragons, 112
 Drexel Aerological Station, 372
 Drift voyage in the Kara Sea, *note*, 361
 Druses, 88, 92, 105, 106, 107, 108
 Religious head (ill.), 104
 Sheikh of the Ledjâ (ill.), 103
 Types (ill.), 105
 Younger generation (ill.), 106

Dryer, C. R., 139

Mackinder's 'World Island' and its American "satellite" (with map), 205-207

Dunes

Ordos Desert (ill.), 237

Dutch Guiana

Cotton growing, 49

E

Earthquakes

Canal Zone, 196

Economic geography

Labour and Industry in Australia (Coghlan), *rev.*, 366

World's food resources, The (von Engel), 170-190

Economics

Economic Statesmanship (Barker), *rev.*, 213

Study, A, of Industrial Fluctuation (Robertson), *rev.*, 214

Ecuador

Cotton growing, 50

Egerton manuscripts, 111, 112, 113

Ekblaw, W. E., 166

Elsgau, 54

Engeln, O. D. von

World's food resources, The, 170-190

Epamanduodurum, 52, 54

Erosion

Desert, *note*, 211

Lop Desert, 4 (ill.), 6 (ill.), 7 (ill.), 10 (ill.), 11, 12, 13 (ills.)

Esayoo, *note*, 142, 144

Escarments

Niagara, 264

Eskimo culture

Arctic geography and Eskimo culture: A review of Steensby's work (with maps) (Wissler), 125-138

Indian culture and, 129, 136, 137, 138

Musk-ox basis, 128, 134, 137

Original seat, 127

Sealing conditions as basis, 129, 132

Typical cycle of activities, 132

Eskimos

Divisions, 126

Greenland, Rasmussen's study, *note*, 210

Habitat and migration routes in American Arctic (maps), 130, 131

Language and blood, 127, 138

Migration routes in Greenland, 137

Peary and, 161

Recent migration and its forerunner, *note*, 142

See also Eskimo culture

Etah, 143

Ethnology

Arctic geography and Eskimo culture: A review of Steensby's work (with maps) (Wissler), 125-138

Greenland Eskimos, *note*, 210

Macedonia, southern, *note*, 209

See also Migrations

- Changlopu (*continued*)
 Sand-buried city (ill.), 241
 Choa Ho, 224, 226
 Chapman, R. H., obituary, 365
 Charkhlik, 2
 Chavannes, Pierre
Pays de Montbéliard, The (with map), 51-59
 Chefoo, 326
 Chekiang, 318
 Chiayükwán, 239
 Chihli, 223, 224, 228, 230, 328
 Camel caravan (ill.), 233
 Chile
 Cotton growing, 50
 China
 Arabia and, 307
 Central Asian trade and route, 1, 12, 18, 20, 24
 China: Her History, Diplomacy, and Commerce, etc. (Parker), *rev.*, 219
 Chinese Republic, showing open ports and marts (map), 308
 Open ports of China, The (with map) (Williams), 306-334
 Overland trade with Russia, 311
 Population, non-increase, 179
 Ports, voluntary opening, 314
See also Great Wall of China
 Chinha, 38, 39
 Chinese Eastern Railway, 313, 331
 Chinkiang, 320, 322
 Chira, 38, 43
 Chungking, 323
 Churches
 St. Simcon Stylites, Syria (ill.), 82
 Syrian ruins, 83, 84 (ill.)
 Chüyungkwan, 232
 Circassian villages in Syria, 106
 Cisterns in the Syrian desert, 102
 Civilization
 Desert Syria, the land of a lost civilization (with maps and ills.) (Butler), 77-108
 Origin, *note*, 364
 Clapp, F. G.
 Along and across the Great Wall of China (with map, diagr., and ills.), 221-249
 Clark, C. U., 64
 Clark, K. McR., 349, 350
 Clark, V. S.
 Review of Coghlan's "Labour and Industry in Australia," 366
 Climate
 Balkan Peninsula zones (map), 204
 Mesopotamia, *note*, 361
 Cloudiness
 Maps available for the United States, 349
 United States, Cloudiness in the (with map and diagrs.) (Ward), 347-356
 United States, mean annual (map), 348
 Cockerell, S., 149
 Cod, 254
 Coghlan, T. A.
Labour and Industry in Australia, *rev.*, 366
 Coins, Chinese in Lop Desert, 18, 29
 Colby, C. C., 140
 Cole, Fay-Cooper, *note*, 208
 Colombia
 Cotton growing, 50
 Colonial railroads, 147
 Commerce
 Balkan Peninsula, The pre-war commerce and the commercial approaches of the (with maps and diagrs.) (Day), 277-298
 China, The open ports of (with map) (Williams), 306-334
 Study, A, of Industrial Fluctuation (Robertson), *rev.*, 214
 Coral islands and reefs
 Corals and the Formation of Coral Reefs (Vaughan), *rev.*, 370
 Corea, Wash., 67
 Cornish's (Vaughan) "Naval and Military Geography," etc., and "Strategic Geography," etc., 62, 63
 Cornthwaite, H. G., *note*, 141
 Coronation Gulf, 126, 127, 132, 134, 136
 Corwin (ship)
 The Cruise of the Corwin (Muir), *rev.*, 148
 Cotton
 Cotton growing in South America (with map and ills.) (McBride), 35-50
 "Egyptian," 38, 39
 Sea Island, 46
 Cottonseed, 46
 Cox, H. J., 140
 Crampton, H. E., *note*, 208
 Cranz, David, 127
 Croatian alphabet, 299
 Crocker Land, 164, 166
 Crustaceans, 255
 Cuba, 110, 115, 117, 123, 124
 Cuestas
 Eastern Great Lakes region, 267
 Niagara, 264
 Culebra Cut, 195
 Cullum medal
 Award and presentation to H. F. Osborn, *note*, 64, 66
 Award to Emmanuel de Margerie, *note*, 66
 Cultivation of the soil and rainfall increase, *note*, 141
 Culture, Eskimo, 125
 Cuvier, Georges, 58
 Cvijić, Jovan
 Natural regions, The, of the Balkan Peninsula (after Cvijić) (with maps), 199-204
 Cyclical movements of trade, 214
 Cyclones. *See* Rainfall

Books

- Military geography, some recent books on (Johnson), 60-63
See also Reviews
- Bostra (Bosrâ), Syria, 95, 101
- Boundaries
 Bulgaria, new (map), 300
 Bulgaria, The new boundaries of (with maps), 299-305
- Bowman, Isaiah, *note*, 65
- Boxer rising, 314, 320, 329
- Brand, C. J. Q., 150
- Branford, Victor, and Patrick Geddes
 The Coming Polity: A Study in Reconstruction, *rev.*, 366
- Brazil
 Cotton fields (ills.), 40, 41
 Cotton growing, 43
 Name, 109
- Brazil (island), 336, 339, 343, 344, 345
 Catalan map of 1375 showing (map), 340
 Nicolay map of 1560 showing (map), 342
 Ortelius map of 1570 showing (map), 343
 Pizigani map of 1367 showing (map), 338
 Ptolemy map of 1513 showing (map), 336
- Brazil Rock, 335, 344-345
- Brazir, 336
- Breasted, J. H., *note*, 364
- Breeze, F. J., 140
- Breitfuss, Dr., 362
- Brick, mud, sun-dried, 86, 87
- Bridges
 Ancient Roman bridges in Syria, 93, 94, 98, 99 (ill.), 101 (ill.)
- Bridgman, H. L.
 Peary: An appreciation (with ill.), 161-169
- Brigham, A. P., 139, 140
- British Air Ministry, 149
- British East India Company at Canton, 310
- British Guiana
 Cotton growing, 49
- Brooks, A. H., 61
- Brooks, C. E. P.
 The Secular Variation of Rainfall, *rev.*, 371
- Brooks, C. F., 140, 364 (*note*), 365 (*note*)
 Review of Gregg's "Average Free-Air Conditions... at Drexel Aerological Station," 372
 Review of Terada, Yokota, and Otuki's "On the Distribution of Cyclonic Precipitation in Japan," 218
- Broome, F. C., 149
- Brown, R. N. Rudmose
 Letter to the *Geogr. Rev.* on Spitsbergen, 372
- Brown, Robert M.
 Five years of the Panama Canal: An evaluation, 191-198
 Review of Archer's "India and the Future," 74
 Review of Gorgas's "Sanitation in Panama," 147
- Bryant (V. S.) and Hughes' (T. H.) "Map Work," 61
- Budington, Captain, 144
- Bulgaria
 Area and population at periods of territorial change, 305
 Commercial statistics, 278
 New boundaries (map), 300
 New boundaries of Bulgaria, The (with maps), 299-305
 Territorial development, 1878-1919 (map), 301
- Burâk, Syria (ill.), 91
- Buran, 24
- Burgundy, 54
- Burial in the Lop Desert, 23
- Bush, African (ill.), 157
- Butler, H. C.
 Desert Syria, the land of a lost civilization (with maps and ills.), 77-108

C

- Cairo-Cape Town flight, 149
- Cajander, A. K.
 Studien über die Moore Finnlands, *rev.*, 369
- Calvinism, 55, 58
- Camels
 Caravan in Chihli (ill.), 233
 Grazing on road from Kalgan to Dolon-nor (ill.), 233
 In the Lop Desert, 5, 7, 9, 16 (ill.), 20 (ill.), 21 (ill.), 25, 26, 28
- Canadian Oldland, 265, 271
- Canal Zone, 191
 Economic opportunities, 198
 Slides and quakes, 194, 196
- Canals. *See* Panama Canal
- Cañete, 38, 39
- Canton, 306, 307, 309
- Co-Hong, 310
- Commerce, 315
- Cape Town-Cairo flight, 149
- Cape York Eskimos, *note*, 143
- Cardiff, Wales, 141
- Caribou
 Eskimo culture and, 128, 137
 Habitat in American Arctic (map), 130
- Cartography. *See* Maps
- Carts, Mongolian (ill.), 233
- Catalan map of 1375
 Mayda and Brazil (island) on (map), 340
- Catskills, The (Longstreth), *rev.*, 368
- Ceará, 45, 46
- Chaco
 Cotton growing, 48, 49
- Chad, Lake, 68
- Chaleis, 94, 98
- Chamberlin, T. C., 167
- Chancay, 38, 39
- Changlopu, 235
 Buried temple and city wall (ill.), 242



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